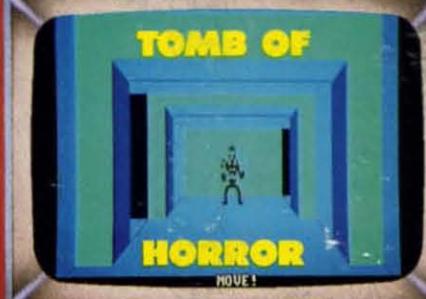




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ISSUE NO. 55

JULY 1988

Ahoy! (ISSN #8750-4383) is published monthly by Ion International Inc., 45 W. 34th St., Suite 500, New York, NY 10001. Subscription rate: 12 issues for \$23.00, 24 issues for \$44.00 (Canada \$30.00 and \$55.00 respectively). Second class postage paid at New York, NY 10001 and additional mailing offices.

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VIEW FROM THE BRIDGE

We have several longer, possibly more significant features in this month's issue that we *could* begin this column by talking about—but to us, this month's biggest news is the return of Buck Childress with his first full-length program in six months. We join Buck in thanking the many readers who've written to ask about his progress. Happily, the eye ailment that sidelined our most prolific programmer is all but licked, and Buck's output should rise steadily in the months to come. (As for Buck's program, *Vari-Scan*, it safeguards C-64 and C-128 programmers from re-using variable names and crashing works in progress. Turn to page 30.)

After good news like that, we hope you won't find our description of the rest of the July *Ahoy!* too anticlimactic:

- As Dale Rupert points out, past *Rupert Reports* have involved connecting your computer to photo-cells, LED's, potentiometers, and relays. This month Dale helps you make the *Thermal Connection*, and turn your 64 or 128 into a digital thermometer. What's next: a Commodore-driven vacuum cleaner? Satellite dish? Roller coaster? Only time will tell. (Turn to page 32.)

- *Window Dressing* means curtains for those drab displays called up by the C-128's WINDOW command. Richard Cur-

cio's quartet of routines let you print attractive boxes and headings, manipulate text, and more. (Turn to page 37.)

- Adventure game fans registered one complaint about *Vault of Terror* (Oct. '86) and *Crypt of Fear* (Feb. '88)—their fingers were trembling so hard that they couldn't type the commands. So Cleve Blakemore designed *Tomb of Horror*, the last entry in his 3-D trilogy, to work entirely via pulldown menus. If you find yourself shaking so much that you can't wiggle a joystick, you're on your own! (Turn to page 48.)

- Mindful that some readers don't like typing in listings of 8+ pages in length, Cleve offers two games that can easily be entered in a single sitting. *Guerilla* lets you go bananas gunning down terrorists who shoot at you from the ruins of bombed-out buildings. (Turn to page 16.) And *Lunar Buggy* dispatches you on an equally patriotic mission—to re-capture the stolen artifact of the Apollo space program and drive it across treacherous terrain to safety. (Turn to page 15.)

- Once you've played all three of the above and asked the inevitable question—"How does Cleve Blakemore do it?" —refer to *Programming Your Own Text Games*, in which Cleve continues to reveal his secrets. (Turn to page 13.)

- Once again, Arnie Katz and the undersigned have been chosen (along with Betsy Staples of *Atari Explorer*) to select the programs for inclusion in this year's CES Software Showcase. We're proud to feature game reviews by Arnie and his partners, Bill Kunkel and Joyce Worley, in every issue. This month's *Entertainment Software Section* covers *Stealth Mission*, *Speed Buggy*, *Wooden Ships & Iron Men*, and *Plasmatron*. (Turn to page 20.)

- If you've been putting off looking into our *COMAL Column*, you're almost out of time. Richard Herring presents the penultimate installment in this issue. (Turn to page 45.)

In case anyone is still confused by our division into *Ahoy!* and *Ahoy!'s AmigaUser*, remember—the next *Ahoy!* for the C-64 and C-128 will be the September issue, on sale August 2. On the stands next month will be the second issue of *Ahoy!'s AmigaUser*—covered dated August, and on sale July 5. And remember, if you're upgrading to the Amiga and want to switch your *Ahoy!* subscription to *Ahoy!'s AmigaUser*, you can—but please call 815-734-4151 or write *Ahoy!*, P.O. Box #341, Mt. Morris, IL 61054. Do not call us at our New York number with subscription problems—we can't help you from here. If you have any *non*-subscription questions, we'd love to help you. Call or write anytime. *—David Allikas*

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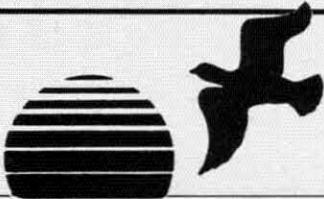
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1541/1571 Drive Alignment

Compute!s Gazette
Dec., 1987

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A new online system offered through CompuServe allows US firms to identify export opportunities and speed up the processing of export licenses. Under the terms of a contract with the US Dept. of Commerce (DOC), exporters can submit their license applications to DOC electronically. A DOC licensing officer will process the application, send a response to the exporter electronically, and follow up with a hard copy of the validated license.

Also new to CompuServe is a database providing detailed information, updated daily, on worldwide trade opportunities. Exporters can search the database by country, SIC code, posting date, and type of procurement.

CompuServe, 614-457-8600 (see address list, page 12).

ILLINOIS SHOW

The third annual Chicagoland Commodore Computer Fest is scheduled for August 28 at the Exposition Center at the Kane County Fairgrounds in St. Charles, IL. National speakers and 64, 128, and Amiga vendors will be featured. Admission is \$5.00.

Computerfest, 312-897-5788 (see address list, page 12).

LET ME TELL YOU 'BOUT...

Why embarrass yourself by your lack of knowledge? *Birds N Bees* lets your kids learn the facts of life interactively. The program, designed by a team of psychologists and consultants, includes treatment of reproduction and child development, plus a special section on protecting children from strangers. The program is designed to let children of any age and either gender receive information specific to their needs. Price is \$49.95 for the C-64, \$59.95 for the Amiga.

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IntraCorp, Inc., 305-252-9040 (see address list, page 12).

SUPER 81 FOR THE 64

A C-64 adaptation of *Super 81 Utilities* joins the C-128 version introduced earlier by Free Spirit. *Super 81/64* will copy whole disks or files from 1541/71 drives to the 1581. The user can back up disks or files with one or two 1541's, 1571's, or 1581's, or any combination thereof. Also included are a full-featured sector editor and utilities for partitioning, scratch and unscratch, lock and unlock, rename, format, and direct DOS commands.

The program is supplied on both 5 1/4" and 3 1/2" disks, and boots on either device 8 or 9. Price is \$39.95; shipping is free.

Free Spirit Software, Inc., 312-352-7323 (see address list, page 12).

PAPERCLIP PUBLISHER

PaperClip Publisher (\$49.95) offers all the text formatting, layout, and de-

sign capabilities needed for creating multiple-column page layouts for newsletters, flyers, price lists, menus, greeting cards, and the like. Documents up to 50 pages in length are supported. Other special features are the ability to temporarily hold and work on text or graphics outside a given document, and a "refreshing" feature that automatically updates any altered section.

Electronic Arts, 415-571-7171 (see address list, page 12).

MUSIC SOFTWARE

Low-cost music programs for the pro or semi-pro:

Passport Sequence Editor (\$14.95) allows step-editing of the MIDI 4+ and 8+ sequence files.

Studio One Editor (\$14.95) works with Syntech's *Studio One* program.

DX21/27/100 Librarian (\$14.95) stores banks and individual voices from Yamaha's 4-operator FM synthesizers.

Generic Librarian (\$19.95), a 32K system-exclusive recorder, works with any instrument capable of bulk Sys-Ex dumps.

SoundWare (see address list, page 12).

CP/M STARTER SET

The PDS *CP/M Starter Set* (\$29.95) is comprised of four disks of utilities and applications for the C-128, plus printed documentation explaining booting up, transient and resident commands, and creating and dissolving library files.

Public Domain Solutions, 813-378-2394 (see address list, page 12).

DRIVE ENHANCEMENT

Microteq's *Drive Box* (\$29.95) permits hardware configuration of the 1541, the 1571, and the C-128D's built-in drive. The box allows for setting the

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... and if you want the ultimate, get **RapiDOS Professional!**

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Mitch S. (Eaglesoft Inc.) - "Very fast, very reliable, and very compatible. I love it!"

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Function	Normal DOS	RapiDOS	RapiDOS Pro	Your System
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Save 202 blocks	196 sec.	98 sec.	8 sec.	
Format 35 tracks	90 sec.	24 sec.	18 sec.	

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RapiDOS requires a socketed kernal ROM U4, and is available in versions for the 64c, 128 in 64 mode, and 1541c (please specify when ordering). RapiDOS is easily upgradeable to the Professional Version. RapiDOS Professional drive controller is (c) '87 mts data GbR, the creators of the best European parallel systems.

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- A must for any MSD SD-2 owner.
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- Adds new Fast Backup commands!
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device number from 8-11, as well as for writing to the reverse side of the disk without cutting an extra notch. Six solder connections are required in order to install the 3 1/8 x 2 x 1" unit; or, Microteq will install it in your drive for \$10 plus shipping (you must insure your drive).

Drive Box is available through Software Support and Free Spirit.

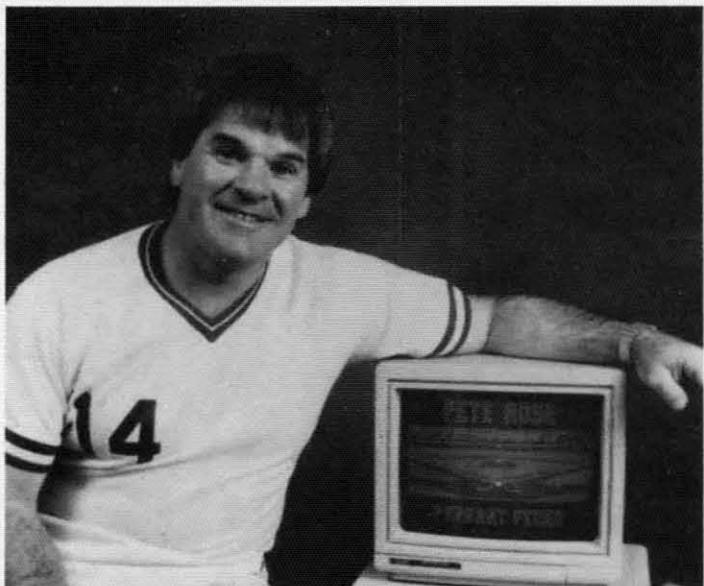
Microteq Systems, 701-232-4033 (see address list, page 12).

KETEK SUPPORT

Computer accessories from Ketek, makers of the Command Center line of system enclosures for the 64, 64C, and 128:

The Sound Trap (\$49.95) encloses almost any 80 column printer with sound-absorbing foam and wood to reduce noise by up to 90%. Included are an acrylic lid and a slide-out shelf for catching printout.

The Remote Power Controller (\$89.00) provides outlets for up to five



Pete Rose
Pennant Fever incorporates the strategies of the Reds star.
You can hit, run, field, and presumably throw body blocks at opposing catchers.

READER
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NO. 175

devices, each offering 3-way protection against surges and spikes. The base unit can mount behind or under your desk, while the 3 1/8 x 5 1/4 x 1 1/4" controller is kept close at hand.

Data Director (\$39.95) makes it pos-

sible for two 6-pin serial devices to share one 64, or for two 64's to share one serial device. The unit works with all Commodore-compatible drives, printers, and interfaces.

The Tilt/Swivel Monitor Stand (\$14.95) lets you turn your monitor to the desired angle, with cushioned pads to hold the monitor securely in place.

Ketek, 319-338-7123 (see address list, page 12).

GAMES

Scheduled for C-64 release in November, *Pete Rose Pennant Fever* lets you guide an expansion team through a 10-season, 24-team race for the pennant. Rather than looking down on the diamond from overhead, you experience the action from the perspective of one of Charlie Hustle's teammates. You pitch, hit, run, field, throw, and steal as you would on a real diamond. Managerial strategies actually employed by Rose are available. In addition, you can act as General Manager, drafting and acquiring computerized players while maintaining control of the club's finances and player salaries. Is there a collusion option? Wait and see.

Activision/Gamestar, 415-960-0410 (see address list, page 12).

Two for the 64 from EA:

Scheduled for late summer release, *Wasteland* (\$49.95) challenges players to survive in the post nuclear year of 2087. As you and your band of Desert Rangers roam the southwestern United States, trying to help other survivors rebuild and live in peace, you'll en-

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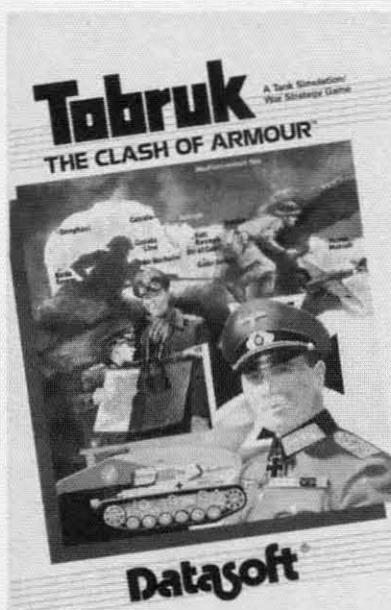
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counter a cast of hundreds, including mutant villains who endanger the population. At certain points in the game, you'll be directed to the included Paragraphs book which enhances the detail of the game and provides descriptive text. After the game is over, you may return to explore locations you were not able to the first time around.

Patton vs Rommel (\$29.95), designed by Chris Crawford, lets the player become either General Blood and Guts or the Desert Fox on D-Day. Each commander has numerous infantry and armor divisions at his disposal, plus a historically and geographically accurate map of 150,000 locations. 10 different kinds of tactical orders are possible, and each division can have up to 32 different orders at a time. To give orders, the players just point at a division and an objective—the army does the rest. As the strategies come to life, players can watch the battles take place, with realistic sound effects. For the C-64.

Electronic Arts, 415-571-7171 (see address list, page 12).

Rommel stars as well in *Tobruk* (\$19.95), in which you command 10 divisions of the Afrika Korps in an attempt to capture the key Libyan port city. Action can be controlled from tactical maps, or directly in land and sea battles. Players view the battle from the turret of a desert tank, with access to

machine gun controls and mines. Air tactics include ground attacks, air-to-air skirmishes, and long-range bombing. The C-64 simulation is designed by Datasoft and distributed by Electronic Arts.

Electronic Arts/Datasoft, 415-571-7171 (see address list, page 12).

Under Fire! (\$34.95) consists of nine WWII scenarios involving the US, Germany, and the Soviet Union, plus a construction set enabling the C-64 gamer to create more.

Avalon Hill, 301-254-9200 (see address list, page 12).

Three C-64 racing games—*Richard Petty's Talladega*, *Shirley Muldowney's Top Fuel Challenge*, and *Grand Prix Motor Mania*—have been combined into Cosmi's *Motor Racing Trilogy* (\$24.95).

Cosmi, 714-240-8985 (see address list, page 12).

Black Jack Academy will teach you to play the game, or help you brush up your skills. Online help explains all play options and coaches you along. Special ease-of-use features include multiple play speeds, card counting option, player card total option, money management guide, and preset multiple table rules from Las Vegas, Reno, and Atlantic City. For the 64 or Amiga; \$39.95.

MicroIllusions, 818-360-3715 (see address list, page 12).

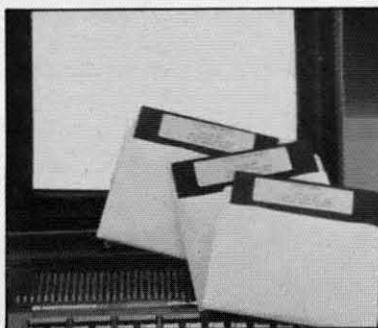
Bridge Baron II (\$39.95), an improved version, plays the complete game of bridge, allowing you to bid and play more than a billion different deals with your C-64 as both your partner and your opponents. New features include two-person mode, rubber bridge scoring, automatic play mode, Baron's recommended bids and plays, the ability to claim or concede tricks, simplified card play, weak 2-bids, and the option to save deals to disk.

Great Game Products, 800-GAMES-4-U (see address list, page 12).

MORE CP/M

Poseidon has published the spring '88 addendum to its catalog of CP/M software, priced at \$1.75 plus a 45¢ SASE (if paying by check, it must be made out to Ralph Lees). New software prices are \$16 for the first disk, \$12 for the second, and \$7 each for all subsequent ones.

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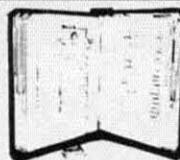
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Poseidon Electronics, 212-777-9515
(see address list below).

BBS FOR 128

Dragonfire BBS 128 (\$100) is designed to allow a novice to get a bulletin board up and running within 20 minutes. It supports 300, 1200, and 2400 baud modems, up to 100 public and 40 private message bases, full E-mail system, remote SYSOP capabilities, auto maintenance mode, security option, self-maintaining system files, and more. Versions for the 64 and Amiga are forthcoming, as are terminal programs for the 64 and 128.

YodaHead Software, 609-596-1772
(see address list below).

SWEEPSTAKES

Computer Learning Month has launched a School Certification Program and Sweepstakes, with a first prize of a computer and software and 30 second prizes. To become eligible, teachers in grades K-12 must use three software programs they have not tried

before between August 1 and October 31. Further details are available from CLM, an official project of the Software Publishers Association.

Computer Learning Month (see address list below).

PAINT PROGRAM

The **Masterpiece** graphics package (\$29.95) lets the C-64 artist move, copy, scale, rotate, twist, and fold the onscreen artwork. Other features include picture compression for saving memory, and the ability to load pictures from BASIC.

Scorpion, 201-663-0202 (see address list below).

GOOD NEWS

P.A.V.Y. has lowered the price of **Landmark, The Computer Reference Bible** from \$164.95 to \$129.95. If you're reading these words before June 1 (as only subscribers are likely to be), you may still be able to get in on P.A.V.Y.'s limited time special price of \$119.95

Continued on page 81

**Companies
Mentioned
in
Scuttlebutt**

Contact manufacturers directly for additional information.

Microteq Systems
1430 9th Avenue South
Fargo, ND 58103
Phone: 701-232-4033

P.A.V.Y. Software
P.O. Box 1584
Ballwin, MO 63022
Phone: 314-527-4505

Poseidon Electronics
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New York, NY 10011
Phone: 212-777-9515

Public Domain Solutions
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Tallevent, FL 34270
Phone: 813-378-2394

Scorpion
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Lake Hopatcong, NJ
07849
Phone: 201-663-0202

The Software Toolworks
One Toolworks Plaza
13557 Ventura Blvd.
Sherman Oaks, CA 91423
Phone: 818-907-6789

SoundWare
P.O. Box 1913
Nederland, TX 77627

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Phone: 609-596-1772

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Palo Alto, CA 94306-6007

Computerfest
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Cosmi
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Wilmington, CA 90744
Phone: 714-240-8985

Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
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LaGrange, IL 60525
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Phone: 800-GAMES-4-U

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Miami, FL 33186
Phone: 305-252-9040

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Phone: 818-360-3715

MicroProse
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Hunt Valley, MD 21030
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PROGRAMMING YOUR OWN TEXT GAMES

Part II of III: Think Modules!

By Cleveland M. Blakemore

Ingenuity lies not in further complicating definitions and concepts, but in reducing the number of contradictions and terms to the fewest possible true sets.

Any given system design must begin with the sum of its parts, and then define these parts.

This is the essential theory behind "black box" system design, or modular programming. We begin by describing what we want the system to do, then breaking this idea down into the necessary steps to accomplish it. Whether you are pursuing a personal goal or creating a computer program, you will find that this approach is always the most effective.

Last month we published a short text adventure called *Lost Dutchman's Mine*. In this installment we will examine this program in detail and demonstrate how a series of modules (or subroutines) can be tied together into one cohesive system that is greater than the sum of its parts. None of the routines by themselves would constitute a game—but working in tandem, they create an interactive adventure.

If we wanted to describe the player's purpose in *Lost Dutchman's Mine* in one sentence, we could say:

"To move around within a network of locations, collect various objects, return them to a specific location, and win the game."

This is the simplest way to define the program's operation. In last month's column, I advised designing your adventure on three separate pieces of paper before touching the keyboard. Page one of my scenario for *Lost Dutchman's Mine* read like this:

"The object of the game is to wander around within a series of caves, collecting up three treasures as you go. When you have all three objects, you return them to a specific base location, drop them, and win the game."

On page two I listed the obstacles I wanted to hamper the player's efforts:

"1. A timber wolf guards the entrance to a burial mound where one of the treasures is buried. The player must find the gun and bullets to kill the wolf.

"2. A secret word is required to pass from the base location to the caverns. (Kind of like PLUGH in *Colossal Caves*.) The secret word is written inside a matchbook cover.

"3. A whistling spirit guards the entrance to the caverns. The player must blow on an empty 7-UP bottle to scare the spirit away.

"4. The burial mound is submerged under water. The player must find and open a reservoir lock through which the mound room can be drained.

"5. A shovel is needed to dig up the third treasure (Dutchman's nugget).

"6. The player must also light a torch, drop enough equipment to fit through a narrow crack, and escape from the room after he opens the reservoir lock."

You may have noticed that a lot of these ideas are taken from other adventure games, many of them classic puzzles. I wanted them to be familiar enough that the game could be solved without too much trouble. I could just as easily have made the game much harder.

On the third and final page, I drew a map detailing all nine locations in the game, complete with references to the objects that would be found there, and the various puzzles specific to those spots.

Using the modular approach, I broke the program down into seven discrete boxes.

1. Initialize arrays and variables
2. Read in data
3. Get command
4. Find verb in command
5. Find noun in command (if any)
6. GOSUB to appropriate subroutine pertaining to verb
7. Data lines

Modules 3, 4, and 5 could all be considered part of the parser, the routine that gets and analyzes player input. I define them separately here to make it clear what goes on inside the routine.

The first thing I typed in, as always, were lines 1530-1610. These lines contain descriptions of the nine locations in the game. I immediately followed with comments to accompany each, in lines 1630-1670. These comments are specific observations in each location. For example, the gas station has a "metal plaque above a glass shelf."

Then, using the third page of my notes (the map) as a

guide, I typed in the data for an array of nine dimensions, each dimension having six elements. This dimension will be known as D(9,6). The six elements consist of the directions North, South, East, West, Up, and Down. This is a numerical array, and the number in each element indicates the location to which that direction connects. Any non-zero number is a pathway; otherwise there is no exit in that direction. I did not type in directions for the gas station, because it is only accessible by use of the aforementioned "magic word."

In the fashion of any sensible hacker, I jumped to lines 120 through 210 and designed a data loader. Once I made sure that the arrays were dimensioned properly in line 120, I read them in a couple of times in lines 190 and 210 just to make sure everything was going smoothly before I continued. This type-n-run approach is the hacking method, and it works. Trust me.

Now for the tough part. I had to figure out all the verbs and nouns that would be needed for the parser's vocabulary. In lines 1800-1850 I tried to give the program a reasonable dictionary of words to work with for player input. An advanced parser would recognize far, far more than this simple collection of words.

Again, I skipped back to the beginning and made sure these strings loaded in correctly before going on.

Lines 1870 through 1900 are detailed descriptions of the objects that can be carried in the player's inventory. Although an object might be referenced by the parser as "diamo," it will be described on the screen as a "glowing diamond." This gives character and atmosphere to the adventure.

Line 1920 is a list of numbers that tells the program where to place objects initially. The first number indicates the location, the second is the object number itself in the inventory. The -1, -1 at the end of the line signals the end of the data.

Lines 1940-1970 are end of game messages, for when the player is killed or is victorious. If the player is killed, these lines help tell him where he made his mistake.

With this, I completed the data lines, the major stumbling block of any adventure game. Although I made many changes afterwards and altered these lines considerably before finishing, these lines gave me something to work with, the meat of the text adventure. The remaining program portions manipulate the data loaded in from here in many ways, but it is in these lines that the game gets its substance.

Important variables to be defined are CL (Current Location) and the arrays O(9,8) and I(8). The former is an array that tells what objects are in what rooms, and the latter is the player's inventory array. I(8) refers directly to the eight objects listed in line 1840, the objects in the game which can be carried. Any non-zero number in element I(1), for example, would indicate that the player is carrying the torch. However, a -1 would mean the torch is burning, while a 1 would mean it is out. I also set up meaningful flag names in line 150. These flags indicate the status of certain items.

In lines 340-540, I fleshed out the parser routines. First the directions, then once the program is recognizing them correctly and responding, I introduce the other verbs. It is better to make sure that all the directions are functioning correctly first before continuing, because a flaw that shows up later might take a lot of work to repair. Make

certain that the directions in the game correspond identically to your map. It is very common to make errors here. I often get East and West mixed up while typing them in.

Line 340 gets the player's input. If he enters nothing, the program checks again. Line 370 checks for a single character input (either a direction or the letter "I" for inventory) and acts accordingly. Since the six compass directions match up with the six single character commands perfectly, I just reduced any of these terms to a number between 1 and 6, subtracting 7 if necessary. I can then use this number to reference the corresponding element in direction array D(9,6). Once a match is found for the verb, the number is placed in the variable V.

The verb is the important part. We use the verb to jump to the subroutine that designates the action, so we must have a verb. The noun, on the other hand, is not always necessary for many actions, and so our parser only looks for it. If it finds one, it places the number of the noun into the variable N before branching off to our routine. The subroutine can then check this variable to see if the player is referencing the correct object. For example, if the player gives the command to dig, we check the variable N to determine whether or not he wants to dig in any particular spot, as in DIG MOUND. If N=0, we simply print a standardized message that reads "YOU DIG FOR A WHILE BUT YOU DON'T FIND ANYTHING."

After the parser has both these variables, V and N, assigned with values, it drops through to lines 570-580, the branches. These lines will steer the program flow into the correct verb actions that alter program variables and the game environment.

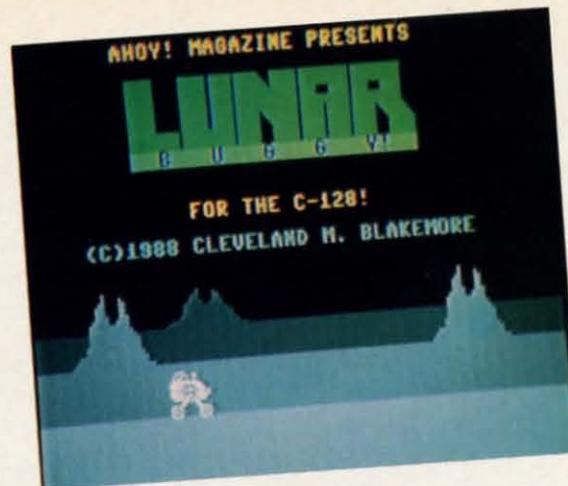
These lines run from 700-1520, accomplishing every possible action that the player is permitted to take in our adventure. If you study them carefully, the variables are self-explanatory and it should be readily apparent that they act on values to change location inventory, specific flags (mound full-empty, wolf dead-alive, etc.), and print messages for the player's benefit.

After program flow returns from these subroutines, the main parser program executes a series of critical checks in lines 600-690. These flags count elapsed time in the current location and check on the player's status relative to certain non-player characters and events. For example, if the player is in room 4 for more than four turns with the spirit, he is going to get it good. The same goes for being in a river full of water too long or beside a hungry wolf.

The check for a win is in line 600. This line checks if a variable called WINGAME has been set yet by the drop subroutine. If the player drops all three treasures in location zero, this flag will be set upon returning from the routine, telling the main program that the player has succeeded.

With as little work as all this, an adventure game was born. We have a full-fledged story, with a plot, characters, and suspense. Next month, we'll go over the specifics of the way the parser functions, and methods we could use to upgrade the routine so that it could recognize complete sentences.

Until then, remember—stop wrestling with the program as a whole and break it down into modules. You cannot move mountains unless you do it one bucket of dirt at a time! □



In the year 2009 A.D. it was discovered that a colony of extraterrestrials had established itself on the dark side of the moon. A Russian installation was attacked and totally obliterated in 2011 when it attempted to approach the alien base to make contact. Following that incident, a United Nations security resolution placed the aliens' location off limits to all international teams until further notice, for fear of antagonizing the otherworldly visitors.

You are a government agent assigned to a secret mission of the highest priority: to recover one of the greatest of all historical artifacts, the Apollo lunar buggy. If you can drive the vehicle over the treacherous lunar plain and past the alien forces, the buggy can be returned to the Smithsonian Museum for posterity. It seems like an impossible gamble,

but you know it will be worth it if you can recover this national treasure.

Lunar Buggy is a jump-and-shoot game similar to *Moon Buggy*, an arcade favorite. It requires a joystick in Port 2. Press the fire button to escape from the title screen.

This game for the C-128 features a background that smooth scrolls past at two different speeds to give the illusion of depth. You've probably seen it before in many arcade games. Lunar mountains pass in front of one another as they move, with the smaller and slower moving terrain in the rear of the display.

To jump, you push up on the joystick. Press the button and push either up or right to fire a laser torpedo. You can jump and fire at the same time if necessary.

The alien ships are a mere nuisance at first, but they can become a real threat later on in the game as they begin to move erratically and with greater speed. Destroy them as quickly as possible, but don't let them distract you from jumping over the many craters in the lunar surface.

Each time you go 500 miles across the moon towards safety, you'll pass an American outpost. These small bases provide short stops to rest and refuel before moving on.

The alien ships are worth the current base number X 100 points each.

If you manage to go 5000 miles in *Lunar Buggy*, you'll have escaped safely and returned the buggy to American soil, where it belongs. □

SEE PROGRAM LISTING ON PAGE 67



THEY TALK THE TALK..

By now you've probably seen all the ads for all the different "Super Cartridges" on the market. And they can talk all day, but let's get real: no cartridge is going to back up 100% of anything, no cartridge is going to turn your C-64 into an Amiga, and no fancy screens or hyperbolic claims are going to give a cartridge any more power than it really has.

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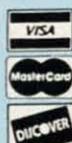
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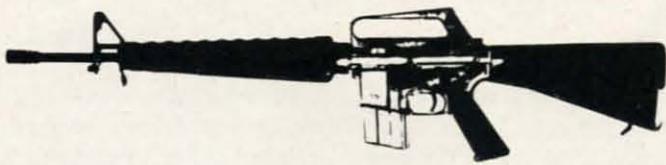
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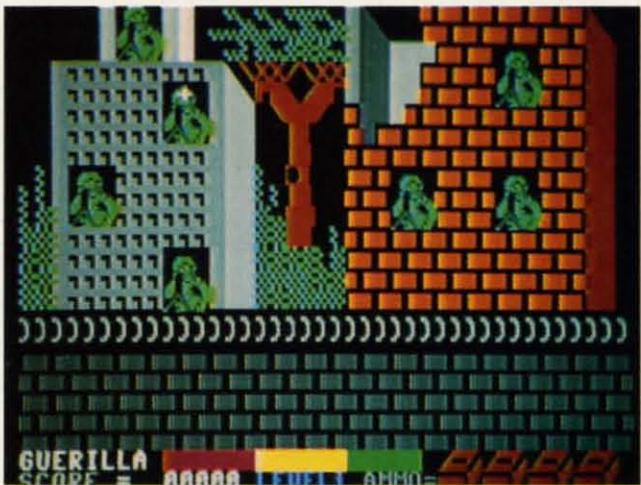


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CRYPTO-SECRET-CRYPTO
(BURN THIS MESSAGE AFTER IT HAS BEEN READ)

TO: RED LEADER TEAM
AT: FORTRESS
REGARDING: GREEN FORCES PENDING
AGGRESSIVE ACTION.
FROM: RED TEAM COMMANDER

WARNING! WE HAVE RECEIVED ADVANCE SCOUT REPORTS OF VERIFIABLE ENEMY ACTIVITY IN YOUR AREA. WE CURRENTLY ESTIMATE THAT ANYWHERE BETWEEN 5 AND 15 BATTALIONS OF ENEMY TROOPS ARE EMPLACING OPERATIONS IN THE RUINS OF CIVILIAN BUILDINGS OPPOSITE THE WALL OF THE RED TEAM FORTRESS. WE ARE ONLY ABLE TO PROVIDE YOU WITH FOUR BOXES OF AMMUNITION AT THIS TIME, AS WE HAVE TO CONSERVE OUR OWN SUPPLY. YOU ARE TO HOLD THE FORTRESS AT ALL COSTS. THIS IS A DIRECT ORDER. THERE CAN BE NO WITHDRAWAL UNDER HOSTILE FIRE. WE EXPECT THAT THE GREEN TEAM WILL BEGIN THEIR ASSAULT ON YOUR CURRENT LOCATION AT DAYBREAK TOMORROW MORNING. EXPECT ENEMY INCOMING BY 0800. IT WILL PROBABLY GET PRETTY HAIRY DOWN THERE.

GOOD SHOOTING...AND GOOD LUCK!

---END OF MESSAGE---

We've never published a really gung ho military game in *Ahoy!*, so I figured it was time to do one. In this short and sweet BASIC-ML hybrid program, you fight off a communist horde who are launching a massive assault on your location. As they appear in the windows of the bombed out ruins on the other side of the stone wall of your fortress, you attempt to shoot them before they can get a bead on the wall with their LAWs (Light Antitank Weapons). If you are too slow, they fire a rocket which blows away a portion of the wall. The resulting damage is registered on the red bar at the bottom of the screen. When this bar vanishes, the fortress has been overrun.

The game uses a joystick in Port 2. The white cross represents your aiming point. Center this on a soldier as he appears in the window and press the button. If you hold the trigger down, the gun will fire continuously. This is very unwise, however, because you only have four boxes of ammo to begin with, and when they are used up, you're at the mercy of the GREEN aggressors.

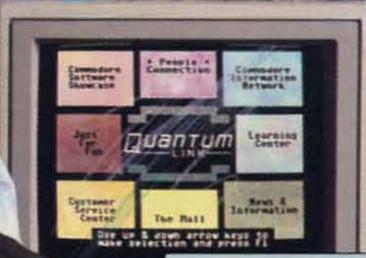
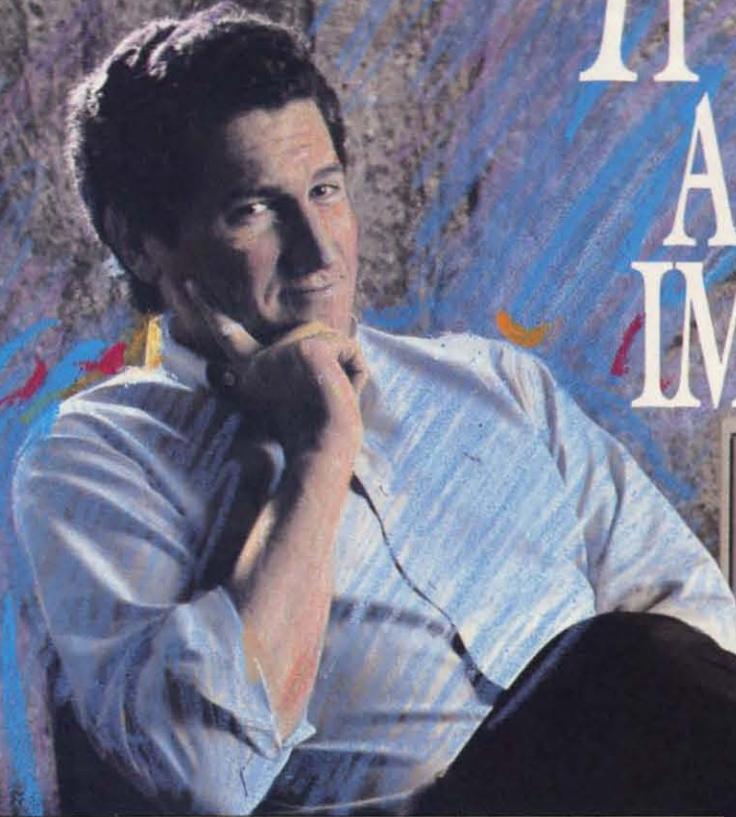
The game has four different attack waves, with complete havoc breaking loose on the fourth one. Soldiers will be popping up in every window and firing everything they've got left to try to destroy the fortress. If you manage to survive this last attack, the RED army will be victorious over the GREEN forces. Otherwise, you'll end up reading propaganda and growing potatoes.

The soldiers are worth 150 points apiece, multiplied by the number of the wave. Any score over 70,000 is good.

It's very difficult to repel the GREEN forces. They're mean. They're hateful. They cross the street against the light. They've got tons of overdue library books. Just last week, they killed Rambo by inserting bullets into his body manually.

Good luck! **SEE PROGRAM LISTING ON PAGE 70**

IT TAKES A LOT TO IMPRESS ME.



BRIAN DOUGHERTY
Software Designer/CEO
Berkeley Softworks

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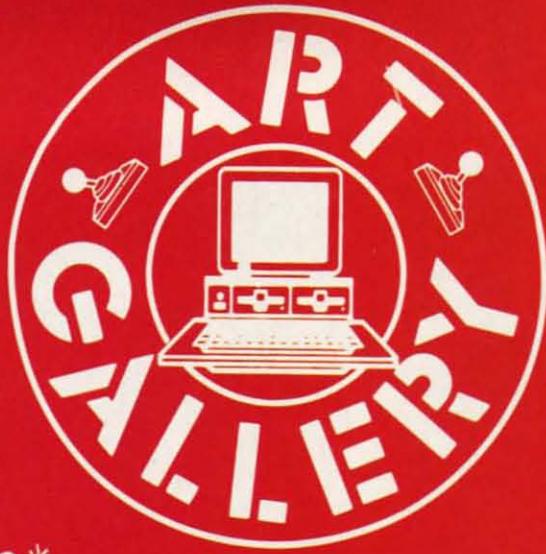
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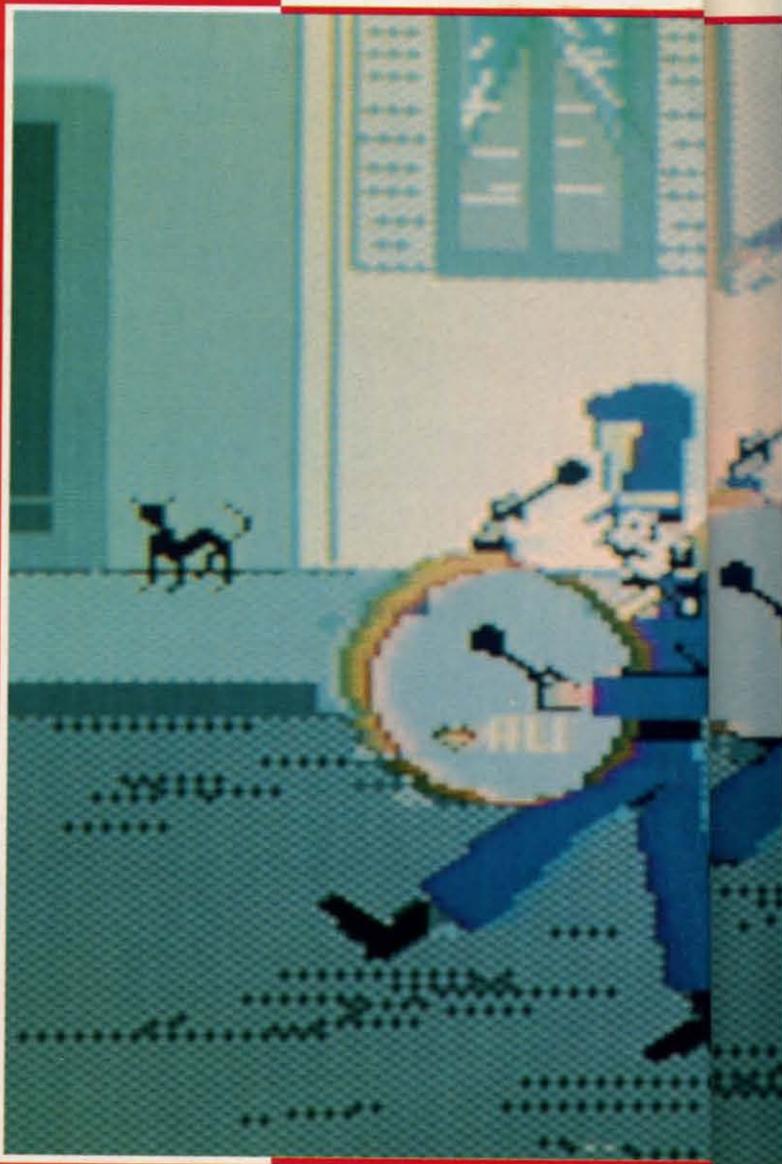


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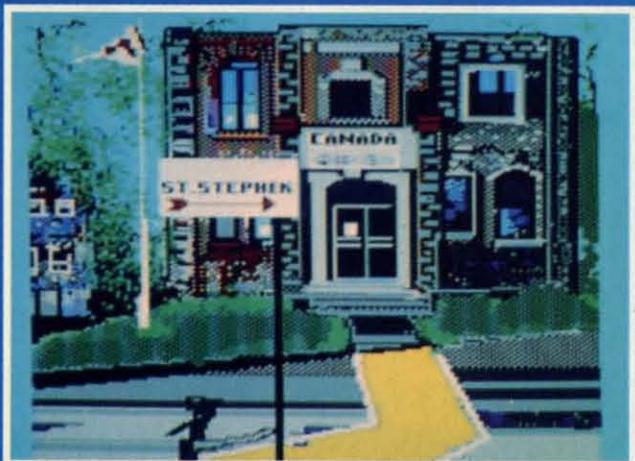
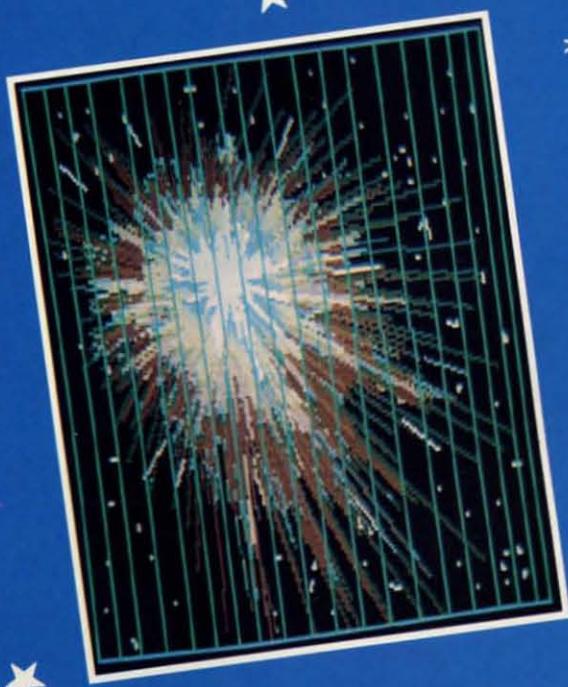
The *Ahoy! Art Gallery* offers the opportunity for fame and fortune to aspiring Commodore artists. Send your work on disk to *Ahoy! Art Gallery*, Ion International Inc., 45 West 34th Street—Suite 500, New York, NY 10001. Indicate the drawing package or file format of the images. Graphics produced on the Amiga are eligible for inclusion in *Ahoy!*'s *AmigaUser*; C-64, C-128, and Plus/4 images are eligible for inclusion in *Ahoy!* If your image is published, you will receive a free one-year subscription. Current subscribers will have their subscription extended by one year.

Note that the *Art Gallery* is not a contest. Published pictures are selected in an arbitrary and capricious fashion by the *Ahoy!* Art Director, based solely on their artistic merit.





Irony of ironies—only two Americans are among the contributors to this month's 4th of July edition of the *Art Gallery*. (Although, as the old joke goes, they have a 4th of July in other countries—they just don't celebrate Independence Day.) At left are two treatments of Presidents' Day—traditional and punk—by Michael Mikottis (Berwyn, IL). Above is *Marching Band* by Heinz Diekert (Vernon, BC), pounding out "Stars and Stripes Forever" just as surely as mom made little green apple pie (or something like that). At right is an unforgettable *Reagan* by Alberto Valsecchi (Milano, Italy), *Fireworks* by Tom Kane (Buffalo, NY), and *Post Office* by Robert M. Ellis (LaSalle, Quebec). True, it's a Canadian post office. But where would our neighbors north of the border be without the American Revolution? Still trapping furs, no doubt, and trading them to us for three-cornered hats and powdered wigs. Here's wishing all our readers a safe and enjoyable holiday.



PLASMATRON

Avantage
Commodore 64
Disk; \$14.95

Plasmatron is a perfect example of what can only be called "generic entertainment software." These generally well-executed but hackneyed game programs are produced in Europe and sold in the U.S. by mainstream publishers. Often the American publisher uses a "discount" label name. In this instance, the Avantage banner signifies Accolade's lower-priced software.

European programmers grind out these rehashes of arcade "standards" like sausage. Games which should be the result of a creative process are instead formulaic and predictable.

On the other hand, as with all generic product, the user knows what he's getting and he gets it at a good price. The entertainment is based on play mechanics that are already proven successes, and the lower price gives gamers a chance to acquire playware at bargain rates.

Plasmatron is just such a piece. Originally produced by The Zen Room and brought to these shores by Avantage, it's a horizontally scrolling science fiction shootout set against a variety of scrolling backgrounds. The user pilots a Plasmatron fighter, a futuristic combat aircraft, over the planet Loughton 2, encountering fierce resistance from hostile forces. (Unfortunately, the skimpy instructions never specify whether these "aliens" are native to this world.) The objective is to blow up as many ships and other targets as possi-

ble, then make it back to base before the limited shields are exhausted.

The enemy ships in the initial attack wave are sitting ducks, but before long the opposition stiffens. Then the player is up against giant insects, floating asteroids, and multicomponent fighter ships which take up to five hits to eliminate completely.

The only remotely original aspect of *Plasmatron* is its visual presentation. At first look, it *seems* to be the familiar side perspective seen in earlier games like *Defender* (Williams) and *Super Cobra* (Stern). The designers, however, actually "tilted" the lower part of the landscape and added the Plasmatron fighter's shadow to help manufacture a 3-D look. This is a purely cosmetic innovation that has no impact on the game whatsoever. But when it comes to generic software, one takes one's innovation where one finds it.

Plasmatron offers simulated three-dimensional graphics, but the inspiration for this pseudo-3D seems to be the old View-Master slide viewer system. When you looked into a View-Master, the world indeed had dimension, but only as a series of spaced backdrops. These backdrops were flat, like two-dimensional stage scenery. That's how *Plasmatron* looks. There's a horizon line about a third up the display area with backdrops slotted in sequence to create the illusion of depth.

The playfield also includes a console which displays the status of the ship's shields, damage, ETA, and lives remaining. It's difficult to speculate about the purpose of a damage reading on a

Plasmatron's only somewhat original aspect is its visual presentation. The lower part of the landscape is "tilted" to help manufacture a 3-D look.

READER SERVICE NO. 151



Featured This Month:

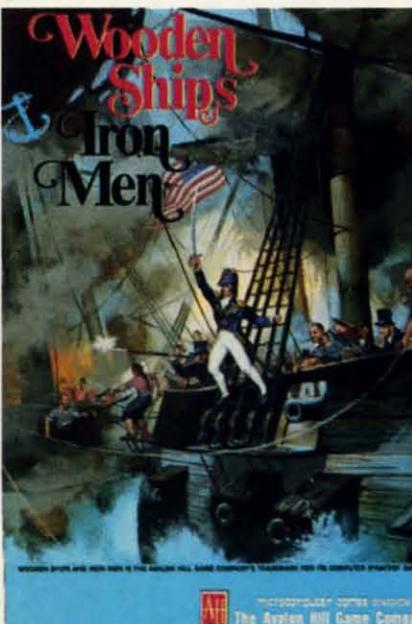
Plasmatron	20
Wooden Ships & Iron Men	20
Speed Buggy	23
Stealth Mission	23

ship which is destroyed as soon as its shields run out, especially since the instructions never even mention that there is a console! Damage is accumulated, however, even while shields remain intact, but the game plays at such a high speed it isn't possible to determine how it is being accrued. Current score and high score displays flank the console.

Plasmatron has some nice graphics and an original look, but there's nothing else here that hasn't been seen hundreds of times already.

Avantage/Accolade Software, 20863 Stevens Creek Blvd., #E, Cupertino, CA 95014 (phone: 408-446-5757).

—Bill Kunkel



For the hard corps computer wargamer.
READER SERVICE NO. 152

WOODEN SHIPS & IRON MEN

The Avalon Hill Game Co.
Commodore 64
Disk; \$35.00

Transferring a military simulation from the tabletop to the computer screen is always a chancy undertaking. Avalon Hill, which has a board game catalogue full of non-electronic classics, has tried numerous times with varying results.

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Wooden Ships has few computer frills.

When S. Craig Taylor, Jr. unveiled the original edition of "Wooden Ships & Iron Men" under the Battleline Games imprint, strategy gamers hailed it as the greatest simulation of naval combat during the age of sail. Time has scarcely dimmed its reputation, so the release of the home computer disk ranks as one of the year's most important electronic gaming events.

Programmer Jim Jacob has executed a fairly literal translation of the board game. As a result, the Commodore edition of *Wooden Ships & Iron Men* makes virtually no use of the unique advantages of the computer. The sound is minimal, the graphics vaguely ape the counters and map of the board game, and gameplay is quite similar to Taylor's original creation.

If Jacob has transmitted the limitations of the board game to the computer version undiluted, the same can also be said of the simulation's strengths. The computerized *Wooden Ships & Iron Men* features the same wealth of detail, historical accuracy, and lively gameplay as its cardboard inspiration.

The main display of this one- or two-player contest is divided into two sections. The upper portion is a scrolling map with a movement grid. Each ship occupies two adjacent hexagons. Although the drawings are not especially detailed, players should have no trouble distinguishing friend from foe.

The lower portion of the screen presents option menus, ship status reports, and results of combat. The computerist employs the joystick to choose orders from menus and confirms them with a press of the action button. The program automatically puts a joystick-controlled cursor on the map when the player needs it for specific movement and firing commands.

Like most Avalon Hill creations, *Wooden Ships & Iron Men* subdivides

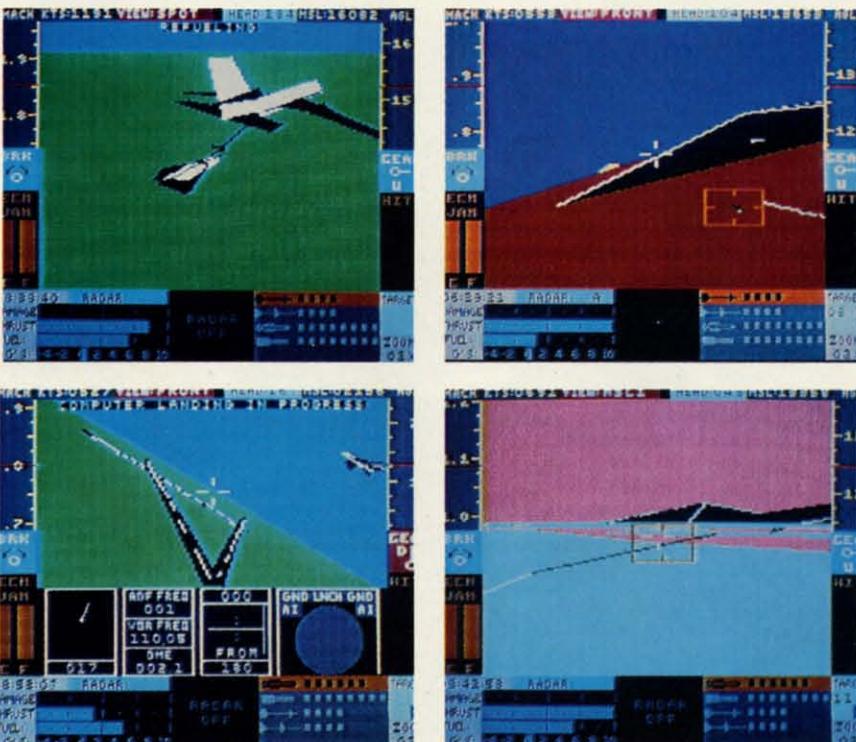
turns into phases for ease of play. The sequence for a complete turn consists of the following phases: wind changes, unfoul tangled ships, movement, drop or raise anchors, grapple with nearby ships, boarding preparation, combat, melee combat and crew transfer, reload guns, and change sails.

Although this list of procedures hints correctly, that this is one complicated game, it's really not so daunting taken step by step. A mammoth 56-page manual contains exhaustive tutorials on

both the routine of play and the construction of customized scenarios.

The ability to create additional battles is a great feature, especially for the naval historians among us, but the prepared scenarios are of paramount importance to most gamers. *Wooden Ships & Iron Men* really shines with 25 engagements drawn from the period from the American Revolution to the War of 1812.

The variety is incredible. The battles range from ship versus ship slug-



While Stealth Mission boasts remarkably accurate cockpit displays, its emphasis is on flight and combat elements. READER SERVICE NO. 153

Speed Buggy offers five tortuous courses, all utilizing big rocks, wooden fences, and brick walls in various combinations as obstacles.

READER SERVICE NO. 154



tests like Constitution against Insurgent to huge multiship actions like the Battle of the Nile and Trafalgar. Most of the battles involve vessels from the US, France, and Britain, but there is some use of lesser powers like Spain and Venice when history so dictates.

For all its outstanding qualities, *Wooden Ships & Iron Men* appeals most strongly to hard corps computer wargamers. It minutely duplicates the board game, but does not add many of the trimmings non-wargamers have grown to expect from their software. Those who want an uncompromisingly authentic recreation of this colorful period in naval combat could well find a new favorite program once they set sail with *Wooden Ships & Iron Men*.

The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214 (phone: 301-254-9200). —Arnie Katz

SPEED BUGGY

Data East

Commodore 64

Disk; \$29.95

To paraphrase an old saying, "God must love driving games. Otherwise he would not have made so many of them." It sometimes seems as though there's a new one every month, each only microscopically different from those which preceded it.

Speed Buggy, the latest title in this genre to reach market, breaks out of this automotive rut. It provides a totally original gaming experience that could never be confused with the sports car and race car simulations.

The gamer employs the joystick to control a four-wheel off-road vehicle. It turns on a dime, accelerates rapidly and, best of all, can skim along on two wheels if the player drives over one of the rocks which the designer has planted so helpfully in the middle of the road. After hours behind the wheel of electronic Indy cars and Corvettes, it's quite a shock to see the buggy launch into the air and sail over road obstacles.

The control scheme is simplicity itself. Moving the stick to the left or right governs lateral motion, slamming it forward puts the pedal to the metal, and pulling it back applies the brakes. The action button shifts between high and low gears. A rudimentary control

panel in the upper right quarter of the screen presents all pertinent data, including the speed, lap number, current gear, and elapsed time.

The disk provides five tortuously twisted courses. The easiest is called "Off road," possibly because it has more hazards than the other four, which are labeled "North," "South," "East" and "West." Each has extensive scenery themed to its name. For example, "South" is a symphony of palm trees, sandy beaches, and pastel colors. All five utilize big rocks, wooden fences, and brick walls as the major obstacles, but the combinations vary greatly from course to course.

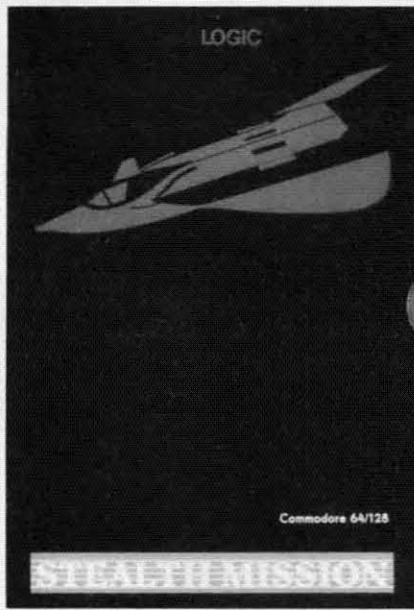
Speed Buggy is a race against time. The vehicle must pass the finish line before the countdown clock reaches zero. If the buggy navigates the entire course fast enough, the player earns the right to try another lap. The hazards are positioned differently for each lap, so there is pleasing variety even for the most skillful drivers.

The scoring system might dampen the spirits of a few novice drivers. Completing that first lap causes a tremendous increase in total score for most players. It is common to leap from a total in the 7000-8000 range to 30,000 in a single race just by beating the first time cutoff. So, until the computerist leaps that hurdle, be prepared for point totals to stay fairly static from round to round.

Like many other Data East productions, *Speed Buggy* bears the telltale traces of insufficient attention to detail. The program itself is fun and highly playable, but all the little things which enhance the gaming experience are either wrong or missing.

The implementation of the vanity board is a perfect example. Because *Speed Buggy* was obviously programmed for use with a tape drive, the disk does not retain high scores once the computer shuts down. There is no reason why this could not have been corrected before American republication. The same goes for the ludicrous title screen. It calls the game, presumably in an English transliteration of the original Japanese, "Buggy Goy." Insert snickers and ethnic jokes here.

Fortunately, none of these trivial flaws directly impacts the gameplay of *Speed Buggy*. It is tons of fun and a



Commodore 64/128

STEALTH MISSION

Included among Stealth Mission's eight scenarios are a mountain conflict, a battle at sea, and a bomber marathon.

terrific addition to the Commodore 64's library of driving games.

Data East, 470 Needles Dr., San Jose, CA 95112 (phone: 408-286-7074).

—Arnie Katz

STEALTH MISSION

SubLOGIC

Commodore 64

Disk; \$49.95

Stealth Mission is a new flight simulator from SubLOGIC. Roll it around in your mouth and say it again: "a new flight simulator from SubLOGIC." Sounds great, doesn't it?

SubLOGIC, in the person of Bruce Artwick, virtually invented flight simulation for microcomputers earlier in the decade. The original *Flight Simulator* (for the IBM PC) and the subsequent *Flight Simulator II* (other home systems) set the standards that dozens of other publishers spent years struggling to surpass. Secondary software, meanwhile, in the form of *FS Scenery Disks*, lets users take off and land their small aircraft anywhere from Chicago to Tokyo, and all points in between.

A few years later, SubLOGIC again blew the whole scene apart with *Jet*. This advanced simulator allows users to climb into the cockpit of several modern combat fighter jets and engage in mach-speed dogfights, aerobatics (stunt flying), and land on the deck of

Continued on page 51

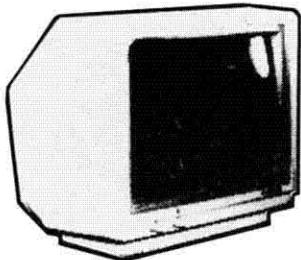
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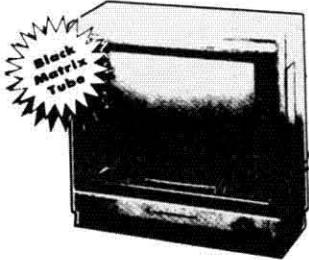
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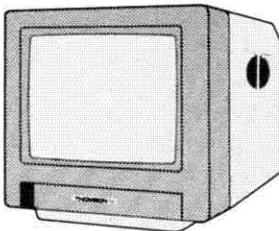
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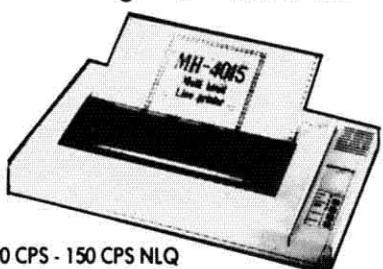
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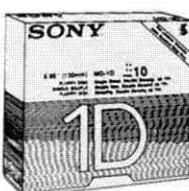
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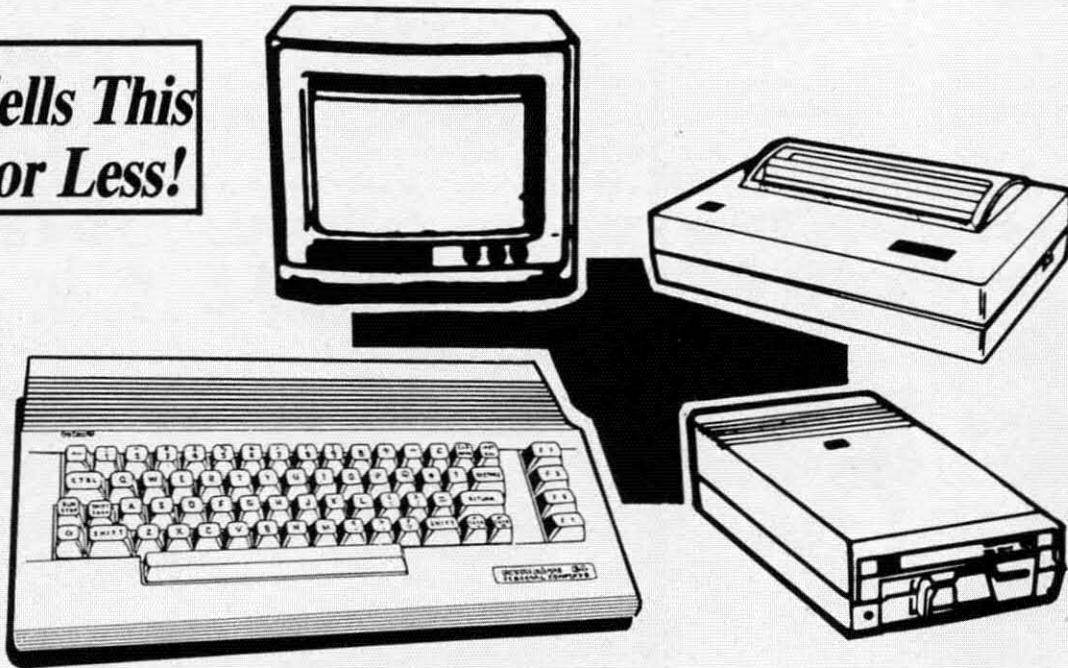
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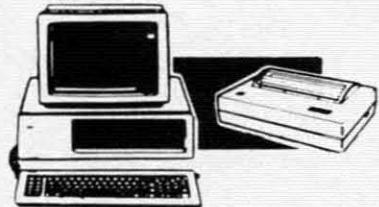
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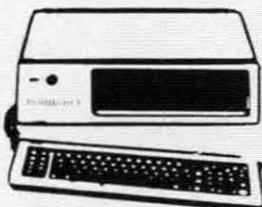
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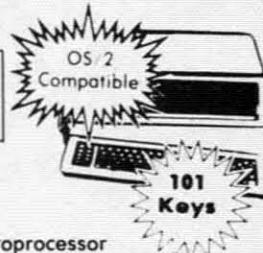
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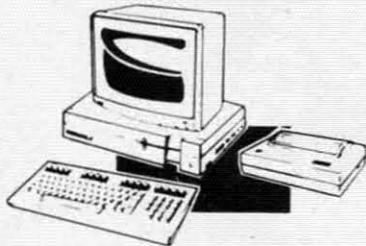
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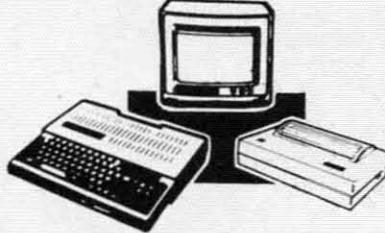
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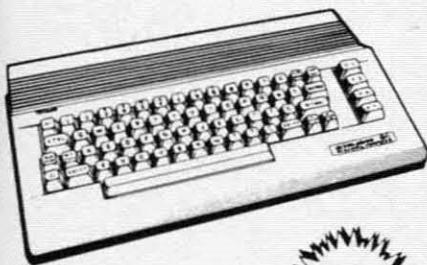
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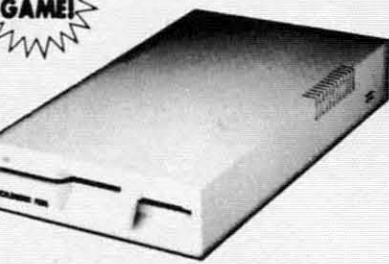
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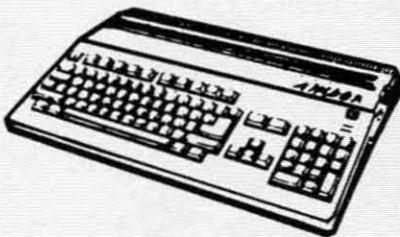
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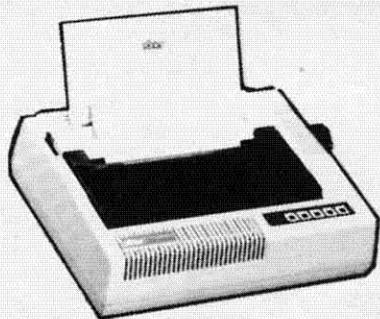
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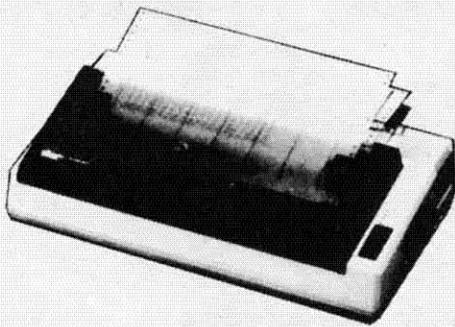
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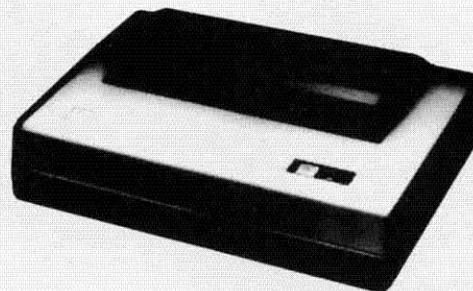
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130 REM VARIABLES AND FRAGMENTS

140 REM CL\$ - CURRENT LOCATION

VARI-SCAN

150 DIM CL\$, WINGAME, WEIGHT, DEAD, ALIVE, WOLF, GHO

160 ALIVE = 1: DEAD = 0: WOLF = ALIVE : SPIRIT

170 FULL = 1: EMPTY = 0: RIVER = EMPTY : MOUND

For the C-64 and C-128

By Buck Childress

Well people, I'm about to hand down a secret recipe for the best RAM chip soufflé this side of Pluto. Just add a head full of frustration, a dash of space bar, and a couple of cursor keys to taste. Mix well, then jump up and down on Ol' Reliable till your anxiety is overtaken by grief. Heck, you've just hurled your trusty companion up to that Great Microchip in the Sky.

Of course I'm just kidding...I think. At any rate, we all get overwhelmed by frustration from time to time. After all, *some* of us are only human. Well, I suppose an explanation is in order.

Variables (or should that be frustration-ables?) have got to be one of the biggest contributors to premature hair loss, fried brain cells, and unintelligible babbling amongst computer programmers. Have you ever been in the process of writing a program, added a new (or so you thought) variable to the list, and then watched in total disbelief as your masterpiece took a nose dive? Shucks, if you'd only known that not-so-original variable was in there, you probably wouldn't be dangling from the ceiling right now. Why don't we get you off that ceiling (how are you going to explain the footprints to the landlord?) and lower the old blood pressure a bit. Maybe with a little bit of practice you'll be able to talk again. As for me, my brain cell just multiplied. With some luck both of them might do it again. Then I'll have four.

There have been programs written that will give a list of variables currently in the program. They work well, but you have to trace through the list to see if the variable you want to use is there. That's okay so long as the program isn't too long and you're not in any kind of hurry. But, when you get on a roll and your creativity and fingers are flying like a Concorde jet, those programs just won't do. So... *Vari-Scan* to the rescue. When you want to find out if a variable is in use, just type it, press RETURN, and bingo. You'll know in less time than it takes to yawn.

Vari-Scan automatically searches out any variable you choose, whether string, numeric, integer, or array. It's easy to use, and gets the job done pronto. It works equally well on both the C-64 and C-128.

After saving a copy of *Vari-Scan*, run it. The loader

POKEs the machine language data into memory and checks for errors. When it's done you can activate *Vari-Scan* by typing SYS 52000 for the C-64, or SYS 4864 for the C-128, and then pressing RETURN.

Whenever you want to see if your program contains a certain variable, just type the variable name and press RETURN. If your chosen victim is in the program, *Vari-Scan* returns the line numbers that have it. They can't run and they can't hide. You've got 'em now.

If the variable you're searching for is an array, you have a couple of options. You can scan for an exact match by entering the entire name such as A(1). A(1) would have to be in the program for a match to occur. But, if you want to know if the variable A is used in any arrays (e.g., A(J), A(1,5), A(2,X,7)), enter the variable name like this:

A (£

The LIRA (£) sign tells *Vari-Scan* to list all occurrences of A as used in arrays.

Vari-Scan can discern the difference between all variables. For example, let's say that you want to search for the variable A1. *Vari-Scan* will only scan for the numeric variable A1. It will not report any integer, string, or array variables of the same name, nor will it inadvertently report a variable containing an A, such as AB. The same holds true for other types of variables. *Vari-Scan* won't scan for anything in quotation marks, or on a line following a REM or DATA statement.

Vari-Scan checks for extended variable names. If you've used HOMES\$ in a home budget program, *Vari-Scan* recognizes it as HO\$ (the same as the 64 and 128 does). So you don't have to worry about some weird variable sliding by your prying eyes.

Vari-Scan can be deactivated by pressing the BACK ARROW (←) key. SYS 52000, or 4864, to reactivate it.

The next time you need an instant variable check, give *Vari-Scan* a try. It's easy to use, gets the job done fast, and keeps variable frustration at a minimum. Besides, who wants to do a tap dance on the keyboard? Then you couldn't use it as a frisbee. □

SEE PROGRAM LISTINGS ON PAGE 64

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Kampfgruppe	\$60	\$41
<u>Panzer Strike</u>	\$45	\$31
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<u>Questron II</u>	\$40	\$28
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Roadwar Europa	\$40	\$28
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<u>Sons of Liberty</u>	\$35	\$24
Wargame Constr.	\$30	\$21
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MICROPROSE

	List \$	Our \$
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F-15	\$35	\$24
Gunship	\$35	\$24
Pirates	\$40	\$28
Silent Service	\$35	\$24
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EPYX

	List \$	Our \$
California Games	\$40	\$28
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SSG

	List \$	Our \$
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<u>Battles Civil War</u>	\$40	\$28
Battles Normandy	\$40	\$28
Carriers at War	\$50	\$34
Europe Ablaze	\$50	\$34
Halls Montezuma	\$40	\$28
Reach - Stars	\$45	\$31
Russia	\$40	\$28
Run 5 Magazine #8	\$4	

ACCOLADE

	List \$	Our \$
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Hardball	\$30	\$21
<u>Plasmatrix</u>	\$15	\$12
Power at Sea	\$30	\$21
Spy vs Spy I & II	\$15	\$12
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<u>The Train</u>	\$30	\$21

ELEC. ARTS

	List \$	Our \$
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Age of Adv	\$15	\$12
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	List \$	Our \$
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<u>Terrorpods</u>	\$40	\$28
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	List \$	Our \$
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Ogre	\$30	\$21
Ultima I	\$40	\$28
Ultima III	\$50	\$34
Ultima IV	\$60	\$41

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	List \$	Our \$
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Thermal Connection

Real-World Interface: Temperature Sensing

The computer can do much more than merely execute programs. When connected to the proper devices, the computer can measure various characteristics of the real world (the world outside of the computer's circuitry), and it can control some of those characteristics. In previous articles we have connected the computer to photo-cells, light-emitting diodes, potentiometers, and relays. This month we will use a temperature-sensing device, a thermistor, to turn the computer into a moderately accurate digital thermometer.

Both the C-64 and the C-128 have built-in analog-to-digital converters. These are called "A to D" or simply "A/D" converters. The function of an A/D converter is to receive an analog input signal and to convert it to a digital value. Specifically, the A/D converters in the Commodore computers give an integer value from 0 to 255, which is proportional to the amount of resistance applied to their inputs.

A TO D FUNDAMENTALS

If you apply a short circuit between the 5 volt supply voltage and the A/D's input, the A/D sees a resistance of zero ohms and converts this to a digital value of 0. If you leave the input to the A/D converter unconnected or open, the A/D sees essentially an infinite resistance between its input and the 5 volt supply. Then the A/D converter gives the largest value it can, namely 255.

The A/D converters in the Commodore computers give an output value of 1 for approximately every 10,000 ohms of input resistance. That is, 50,000 ohms corresponds to an A/D output of roughly 50. This is fairly accurate for resistance below 100,000 ohms and output values of less than 100.

Because of different A/D input circuitry, the C-64 reaches its maximum value of 255 with an input resistance of roughly 500,000 ohms, whereas the C-128 gives a maximum output of 255 with an input of about 250,000 ohms. Note that these are only "rules of thumb." Any serious application requiring

actual resistance values must calibrate the A/D converters. If you need only relative values ("is the paddle turned more to the left or more to the right?", for example), calibration may not be necessary.

Just to eliminate any confusion, I should mention that A/D converters generally convert analog input voltages (not resistance) into digital quantities. (Refer to *Analog to Digital Adventures*, October 1986 *Ahoy!*, for further discussion of A to D conversion.) Since voltage and resistance are related, it is appropriate and more useful to talk about input resistance in this application.

CONVERSION SOFTWARE

The A/D converters are accessed through Control Ports 1 and 2 (the joystick ports) on the right side of the computer. Each port can handle two resistance inputs. Normally game paddles are plugged into the A/D pins of these ports. There are only two A/D converters in the Commodore computer, but there is an electronic switch which can select the inputs from either Port 1 or Port 2. That way two A/D converters take care of four analog inputs.

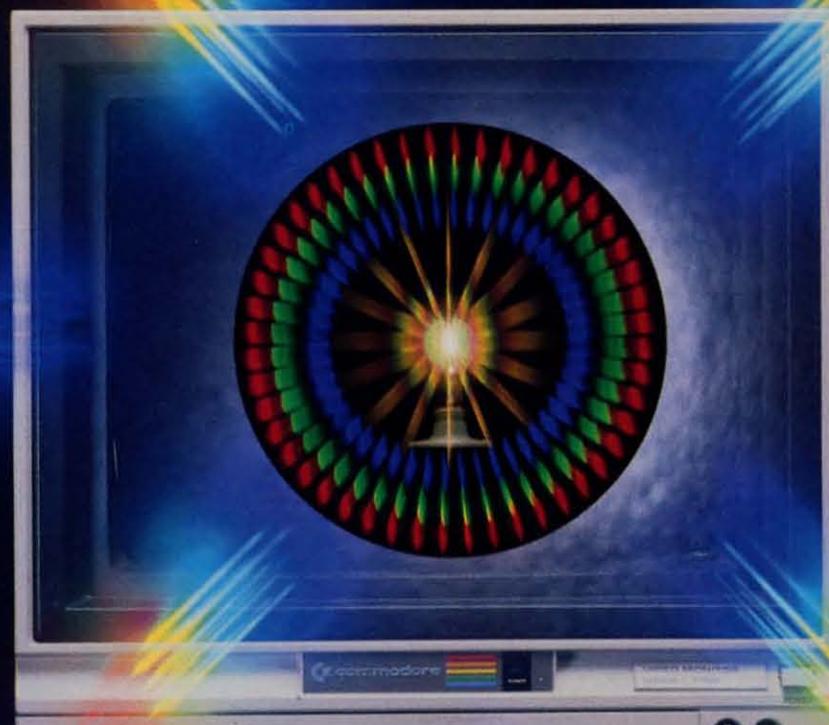
BASIC 7.0 in the C-128 uses the POT command to read the A/D converters. POT(1) and POT(2) give values corresponding to Control Port 1 inputs (closest to the front of the computer). POT(3) and POT(4) correspond to Control Port 2.

For the C-64, you must read the A/D converters by other means. On page 346 of the *C-64 Programmer's Reference Guide (PRG)* is a machine language program for reading all four A/D ("paddle") inputs. It states that reading the paddles from BASIC is not reliable. The machine language program *C-64 Paddle Routine* on page 66 of this magazine is a condensed version of the *PRG* program which allows inputs only in Control Port 1.

The procedure to perform an A/D conversion and to read the results is as follows:

1. Set the electronic switch at address \$DC02 (addresses

By Dale Rupert



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are in hexadecimal) to enable Port 1 or Port 2 (or both) inputs to the A/D converters.

2. Wait briefly for the inputs to be converted.

3. Read the outputs of the two A/D converters at \$D419 and \$D41A.

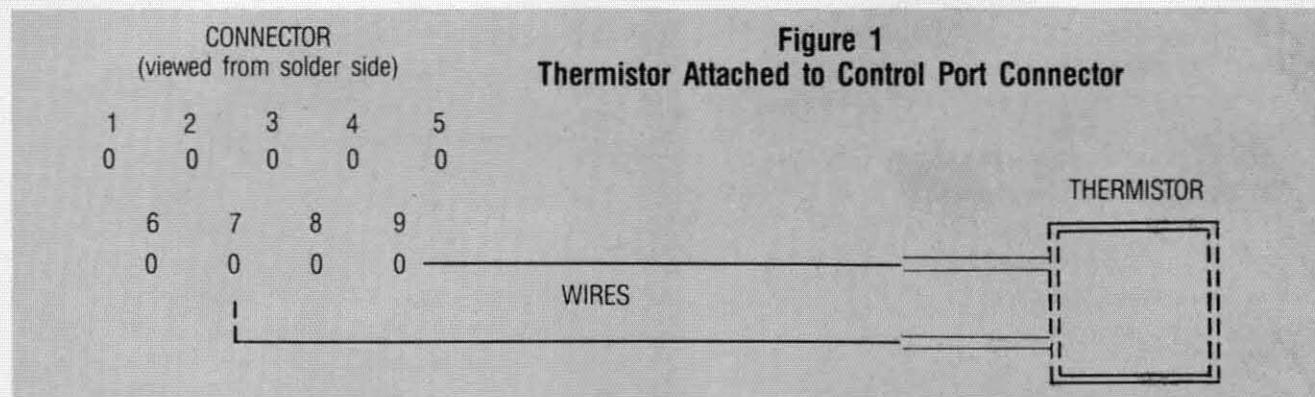
The remarks at the beginning of the machine language program provide more details. Note that interrupts must be disabled. The Complex Interface Adapter (CIA) chip has pins which can be inputs or outputs. Two of its pins (PA7 and PA6) are tied to the electronic switch. The Data Direction Register (DDR) of the CIA at address \$DC00 must be programmed so that those two pins are outputs. Then 1's are written to those two pins to close the switches and bring the Control Port paddle signals to the A/D converters.

This machine language program enables the inputs from both Port 1 and Port 2, although only Port 1 will be used. The A/D converters are part of the Sound Interface Device (SID) chip. They continuously convert whatever input is available. If nothing is plugged into either control port, the A/D converters see infinite resistance and give values of 255.

Although the *PRG* says BASIC is not reliable, I have found that these statements work nearly as well as the machine language routine:

```
PRINT PEEK(54297)
```

```
PRINT PEEK(54298)
```



They read the SID chip's A/D registers at \$D419 and \$D41A. The first address is for the A/D converter for input resistance between pin 7 (5 volts) and pin 9 (POT X) of the control port connector. The second address is the A/D converter which measures resistance between pin 7 (5 volts) and pin 5 (POT Y). Here "POT" stands for "potentiometer," which is a variable resistor.

HARDWARE PREPARATION

You need less than \$5 worth of parts to convert your computer into a digital thermometer:

1. Subminiature D 9-pin female connector (Radio Shack 276-1538 or equivalent).
2. Thermistor (Radio Shack 271-110 or any other with at least 10,000 ohms at 25 degrees C).
3. Wire: any length, 20 to 24 gauge.
4. Epoxy or waterproof glue.

Solder two equal lengths of wire (I used about four feet

for each) to pin 9 and pin 7 of the 9-pin connector. Pin 9 is the POT X (paddle) input, and pin 7 is 5 volts. For convenience, you may twist the wires together.

Thermistors come in a variety of sizes and shapes. The one listed above is a small bead about the size of a pencil tip. Thermistors have two wire leads attached to them. The two leads of the thermistor are soldered to the other ends of the wire. It doesn't matter which wire goes to which lead of the thermistor. The schematic of the finished apparatus is in Figure 1.

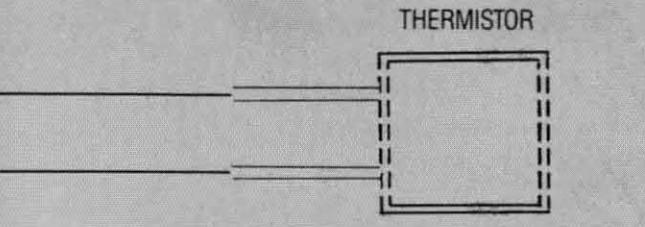
Before using the thermistor with the program we will discuss, you must make its leads waterproof. Daub some epoxy, silicone glue, or other waterproof glue around the leads of the thermistor and the ends of the wire to which they are soldered. Don't coat the body of the thermistor itself any more than necessary to seal the leads. (Be sure the leads are not touching each other.)

PLUG IT IN

After constructing the thermistor apparatus, plug it into Control Port 1 (the joystick port on the right side of the computer, the one closer to the front of the computer).

Remember that computer chips connected to pins on the Control Port connectors are static-sensitive. Chips in the computer can be damaged by electrostatic discharge. Discharge yourself by touching something metal before connecting or disconnecting anything (joysticks included) at these connectors. Don't use your computer in a very dry, static-prone environment without proper precautions.

Figure 1
Thermistor Attached to Control Port Connector



Turn on the computer and enter this quick program:

C-64 VERSION:

```
10 PRINT PEEK(54297), : GOTO 10
```

or

C-128 VERSION:

```
10 PRINT POT(1), : GOTO 10
```

You should see a series of very close numbers, typically about 15 for the thermistor listed above at room temperature (70 degrees Fahrenheit). Those numbers are the digital outputs from the A/D converter as it measures the resistance of the thermistor.

If you get very erratic numbers, or all zeros, or all 255's, then something is wrong. All zeros means that either the

wires or thermistor leads are shorted together (touching). Look closely at both ends of the wires and check the connector for solder bridges.

All 255's means that either the wires are not well-soldered to the connector or to the thermistor, or the connector is not plugged into the computer connector firmly, or the thermistor is open-circuited (faulty), or the connector is plugged into the wrong control port.

If you see very random numbers, make sure you are plugged into Port 1. Turn your computer off, then back on, and reenter the program (make sure some other programs in the computer are not interfering with the thermistor—this would be a problem with only the C-64 version).

THE THERMISTOR

If all went well, the number repeatedly displayed is a digital representation of the thermistor's resistance. Squeeze the thermistor in your hand. You should see the value on the screen change. It should decrease since the resistance of a thermistor decreases as the temperature rises. Notice that the value on the screen gradually changes to the new value. It takes a while for the thermistor to change temperature.

The advantages of the thermistor for our application are that it is a resistive device (unlike a thermocouple which is a voltage device), it is inexpensive (unlike a platinum Resistive Temperature Device or RTD), and it has a relatively large thermal sensitivity (its resistance changes by a factor of ten or more for a one hundred degree temperature change).

The disadvantage of a thermistor is that it is very nonlinear. This means that its resistance does not change uni-

formly with temperature. In fact, the relation between resistance and temperature for a thermistor is given by this equation:

$$1/T_2 = 1/T_0 + 1/B * \ln(R_2/R_0)$$

If the thermistor's resistance R_0 is known at a certain temperature T_0 , and if a calibration constant B is known for the thermistor, then any other temperature T_2 may be calculated from the above formula by measuring R_2 , the thermistor's resistance at that temperature. Note that \ln is the natural logarithm function given by LOG in BASIC. Also note that temperatures must be given in degrees Kelvin. More on that later.

As we have seen, our computer has the ability to measure the thermistor's resistance. We will also let the computer perform the calculations in the formula to tell us the new temperature.

CALIBRATION CAN BE FUN

We must measure the thermistor's resistance at two different *known* temperatures in order to calculate B , the calibration constant. The procedure we will use is this:

1. Measure resistance R_1 at room temperature T_1 .
2. Measure resistance R_0 at ice water temperature T_0 .
3. Calculate B , derived from the previous equation, since T_1 and T_0 are known:

$$B = \ln(R_1/R_0) / (1/T_1 - 1/T_0)$$

You could use any two temperatures, but these are easy to obtain.

Once the computer determines the calibration constant

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B, the thermistor can be used to measure any other unknown temperatures. The computer will determine any new temperature T2 with this procedure:

1. Measure resistance R2 at the new temperature.
2. Calculate the new temperature T2:

$$T2 = 1 / [(1/T0) + (1/B) * \ln(R2/R0)]$$

Notice that since this formula depends upon the ratio of the two resistances, it doesn't matter what units they are measured in as long as they are the same. We will use arbitrary Commodore A/D converter units for measuring resistance. Temperatures must be in degrees Kelvin.

PUT IT ALL TOGETHER

If all the preceding has seemed too complicated, fear not. The program *Thermal Connection* on page 66 takes care of all the difficulties. Before you run this program you must

- 1) find out what your room temperature is (use a thermometer or look at your thermostat) and
- 2) put some cold water along with some ice cubes or crushed ice into a dish and set it where your thermistor plugged into the computer can reach it.

Plug the thermistor into Control Port 1 and run the program. Note that C-64 users must change lines 100, 1020, and 2030 as shown in lines 5001-5003. Also, C-64 users must add line 11 (shown in line 5000) and add lines 5010-49184. These changes for the C-64 replace the POT(1) function of the C-128.

The program asks if you already know the calibration constants for the thermistor. If you reply "N" to indicate that you don't know them, the program starts the calibration process beginning at line 3070. You must have the thermistor at room temperature (or any other known temperature except the freezing point of water). Enter that temperature in degrees Fahrenheit. (The computer will convert it to degrees Kelvin in line 3180.)

The program calls the routine at line 1010. You will see a display on the screen similar to the earlier test of the thermistor. Once the numbers appear to have settled to one or two values, press any key. The program calls the routine at line 2010 to read and average the next ten resistance readings. This value is R1, which corresponds to your room temperature T1.

Now you are instructed to put the thermistor into the ice water. The computer assumes its temperature T0 is 32 degrees F. Press any key to see the new A/D values on the screen. You should see them gradually increase until they reach some steady level. Again press any key once the numbers appear to have settled to one or two values. The computer averages the next ten readings and calls the result R0, corresponding to T0.

The computer has all the information to calculate the calibration constant B in line 3200. The values of B, T0, and R0 are then shown on the screen. You should write them down. That way, the next time you run the program you can enter them manually rather than going through the calibration process again. (My values with the listed thermistor are typically B=2884, T0=273, and R0=29. Room temperature T1 of 293 degrees K (68 degrees F) gives an A/D reading R1 of 15.)

Press any key once you have recorded the calibration con-

stants. You are returned to the main loop at line 100 which repeatedly reads the thermistor's resistance R and converts it to a temperature T in degrees Kelvin in line 110.

There are four user-defined functions beginning at line 20. FNR takes any number and properly rounds it off to one decimal place. FNK2F ("K to F") takes a temperature in degrees Kelvin and converts it to degrees Fahrenheit. FNF2K converts degrees Fahrenheit to degrees Kelvin. FNT is the basic thermistor formula which converts resistance into temperature in degrees Kelvin.

Line 120 converts the calculated temperature to degrees Fahrenheit, rounds it off, and displays it. Line 130 converts degrees Kelvin to degrees Celsius (TC = TK - 273), rounds it off, and displays it as well. The Kelvin temperature scale is sometimes called the "absolute" temperature scale since 0 degrees Kelvin is absolute zero—the lowest possible temperature.

ON YOUR OWN

Even though the temperature is displayed to the nearest tenth of a degree, the thermistor and the A/D converter in the computer do not really provide that resolution or accuracy. You will notice that at higher temperatures such as 130 degrees F (holding the thermistor near a light bulb), the readings jump by as much as 20 degrees at a time. This is because a difference of one in the A/D reading corresponds to 20 degrees in this temperature range. The resolution is even worse at higher temperatures, but it is still adequate for many applications.

You can write a program to monitor the temperature every fifteen minutes and to graph the results. You might have the computer generate an alarm sound whenever the temperature exceeds a specified range. Data logging and remote sensing are just two of the advantages of using your computer as a thermometer.

A second thermistor can be easily added to Control Port 1. Add another wire to pin 7 (5 volts) and a wire to pin 5 (POT Y). In *Thermal Connection* read the second thermistor with PEEK(252) instead of PEEK(252) for the Commodore 64, or use POT(2) for the Commodore 128. It is possible to connect and read as many as four thermistors at once, but C-64 owners should use the four-paddle program given in the *Programmer's Reference Guide* if more than two are used.

You can measure relative humidity with two thermistors. Wrap one in a cotton wick and keep it wet. Spin it rapidly overhead in a medium-sized circle and record the temperature. Leave the other one dry and record its temperature. The temperature difference between the two is because of the evaporation rate from the wet one, and that depends upon the relative humidity. A book on meteorology or psychrometry will show you how to convert the temperature difference into relative humidity.

Let me know what other applications you come up with. Hmm. I wonder how cold the rock salt and ice makes my ice cream freezer. I wonder if my old 1541 disk drive is really hot enough to melt steel. I wonder how well my attic insulation works. I wonder how much the temperature in my refrigerator varies throughout the day. How did I ever manage without a computer-based thermometer? □

SEE PROGRAM LISTINGS ON PAGE 66

WINDOW DRESSING

For the C-128

By Richard Curcio

A well-placed window can give a C-128 BASIC program a very sophisticated look. The WINDOW statement in BASIC 7.0, however, is essentially a no-frills command. *Window Dressing* provides four routines to enhance your text screen displays. Program 1 POKEs the machine language for *Window Dressing* into location 4864. It can be located elsewhere by changing the variable SA in line 110. The program uses 247 bytes plus 200 bytes for storage immediately after the ML. The four routines are accessed with SYS statements. If SA is the start address, then FRAME=SA, AT=SA+3, CR=SA+6, and ED=SA+9.

WINDOW FRAME

Calling FRAME quickly prints a neat box around the perimeter of the current window and (optionally) a heading at the top of the box. A window is then opened inside the box. Your WINDOW statement should therefore open a window two columns wider and two rows taller than needed. The syntax is SYS FRAME [,,, heading]. The five commas *must* be present if a heading is called for. The routine uses the current character color and mode (normal or reverse) for the frame. The characters used are COMMODORE A, SHIFT *, and COMMODORE S for the top, SHIFT-, cursor right, and SHIFT - for the sides, and COMMODORE Z, SHIFT * and COMMODORE X for the bottom. These characters were chosen because they appear the same in uppercase/graphics or upper/lower case. They can be changed.

The heading can be anything PRINTable: string or numeric variables or literals, color changes, cursor controls, etc. The heading begins at the upper left corner of the frame. Start the heading with a cursor right if you don't want to overwrite the corner character. There is no error checking of the length of the heading versus the width of the win-

dow. If the heading is a string variable, the LEN and RWINDOW(l) functions can be used to determine if the heading is too long for the window's width. Note that RWINDOW(0) and (1) return the number of rows or columns minus one.

Once the inner window is opened, the routine performs a "dummy" PRINT. This turns off reverse printing if it was enabled.

PRINT AT AND CURSOR RESTORE

While CHAR can be used as a form of PRINTAT on a text screen, there are a few problems with this. The CHAR statement will only print characters within quotes or string variables. Numeric values must first be converted to strings using STR\$. Strings must be concatenated if you want to include more than one in a CHAR statement. CHAR0,5, 10,M\$;H\$ causes a SYNTAX error. Once CHAR has moved the cursor, it cannot easily be returned to where it came from. Early versions of the C-128 ROMs have a bug when CHAR is used in 80 columns.

The Kernal PLOT routine at 65520 (or 49176) could be used to move the cursor to a selected row and column before a PRINT statement. The "AT" routine provides a few enhancements to this approach:

SYS AT, flag, row, column [,,string]

The first value, flag, determines whether the cursor will be returned to where it was before SYS AT. This parameter cannot be omitted. If 0, the cursor is restored. Any value from 1 to 255 defers cursor restoration. The cursor position is saved, but will not be restored until SYS CR. This allows us to follow SYS AT with multiple PRINT statements before returning the cursor to its original position, if at all. Row and column refer to the current window dimensions. Note that these are in a different order than that used by

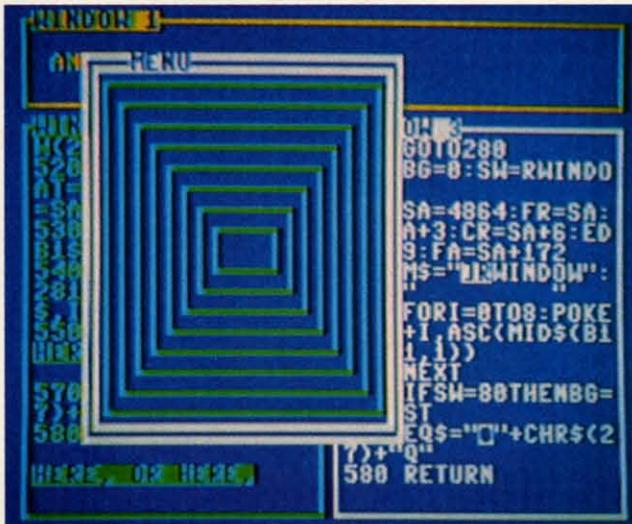
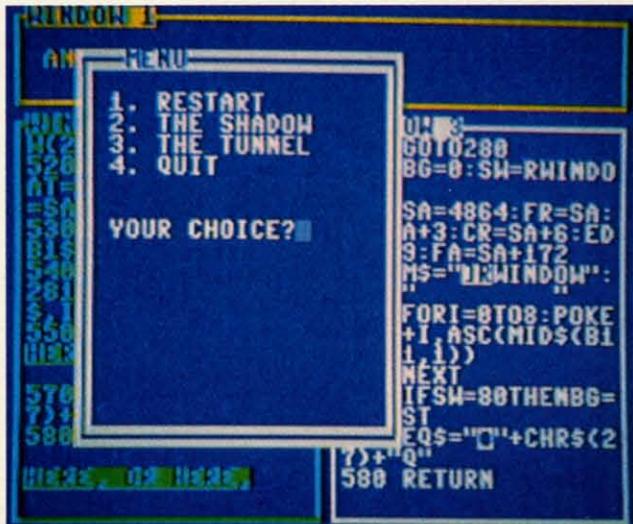


PHOTO: MICHAEL R. DAVILA

CHAR. If row or column are beyond the dimensions of the current window, AT returns with ILLEGAL QUANTITY. Error messages for this routine and the next can be turned off by POKEing any non-zero value into SA + 21. Your program could use RWINDOW(0) or (1) to determine the window dimensions and make corrections if an upcoming row or column will be out of range.

The double commas preceding "string" must be present. String is anything PRINTable, including ESC codes. Although there are routines in ROM to save and restore the cursor position, these are used by a number of ESC characters. If AT were to use these routines, certain ESC codes in the AT string would destroy the previous cursor position. The AT routine stores the cursor column and row in more secure locations (SA+22 and 23). SYS CR restores the cursor to where it was before the most recent SYS AT.

ED

A number of locations in zero-page and page three keep track of the screen dimensions, character color, cursor location, where the tab positions are, and which screen lines are linked or continued from the previous line. These values are called the Screen Editor variables. The final routine saves and recalls five sets of editor values:

```

10 SYS700
20 .OPT P,00
30 *= $1300
40 ;
50 :----- WINDOW DRESSING
60 ;
70 CHRGOT = $0386
80 ;
90 :ENTRY POINTS
100 ;
110 CLV:BVC BEGIN;DRAW WINDOW FRAME
120 ;
130 CLV:BVC PRTAT;PRINT AT
140 ;
150 CLV:BVC RSTCRS;RESTORE CURSOR
160 ;
170 CLV:BVC LINKS;SAVE/RECALL ED VALS
180 ;
190 FRAME .ASC "[c A][s *][c S][s -][RIGHT][s -][c Z][s *][c X]";FRAME CHR
200 ERRENB .BYT 0;ERR MSG ENABLED
210 TEMP .BYT 0,0;HOLDS CCSR ROW/COL
220 ADDTBL .BYT 0,40,80,120,160;USED TO
CALCULATE STORAGE LOCATION
230 ;
240 BEGIN JSR $C150;CSR HOME
250 LDA $F8
260 STA $CF;SAVE SCROLL FLAG
270 JSR $CAE5;DISABLE SCROLL
280 LDX #$FF
290 JSR FRPRT
300 LDY $E5;GET TOP ROW
310 INY
320 STY $CE
330 LFTEDG JSR FRPRT;START AT LEFT EDGE
340 INC $CE
350 LDY $CE
360 CPY $E4;HAVE WE REACHED BOTTOM?""
370 BEQ BOTTOM
380 DEX
390 DEX
400 DEX
410 BNE LFTEDG
420 BOTTOM JSR FRPRT
430 JSR $C854;CSR RT MOVES TO HOME
440 JSR CHKSTR;PRINT ANY HEADING
450 LDA $CF
460 STA $F8;RESTORE SCROLL FLAG
470 ;
480 SMALL INC $E5
490 INC $E6;OPEN A WINDOW

```

SYS ED, set, dir

where "set" is 0 - 3 and "dir" is 0 to save, and any non-zero value to recall. This will allow a program to jump from window to window, printing menus, receiving INPUT, or resuming PRINT where it left off. For four sets of editor values, the routine uses 200 bytes immediately following the ML. Storage can be moved elsewhere. Note that the contents of the screen are not saved—only those parameters mentioned above.

THE DEMO AND ALTERATIONS

Program 2 demonstrates usage of the *Window Dressing* routines. It assumes that the ML is located at address 4864. Change the value of SA in line 520 if *Window Dressing* is located elsewhere. The program determines which screen is in effect using RWINDOW(2) in line 510, and adjusts itself to 40 or 80 columns. In line 530, alternative frame characters are defined. The codes for these characters are POKEd into the cassette buffer. When needed, the FRAME routine is altered to use these characters by POKEing SA + 172 and 173 with the low byte and high byte of the first address of the new characters. (POINTER cannot be used for this because the characters must be in RAM 0 with the

Source Code for Window Dressing

Compiled in 64 mode using the *PAL* assembler (Pro-Line, Inc.)

```

500 DEC $E4
510 DEC $E7;INSIDE THE FRAME
520 JSR $CA32;CLR SCREEN LINKS
530 JMP $C76F;PRINT RETURN & RTS
540 ;
550 PRTAT PHA;RESTORE CURSOR IF A=0
560 LDA $E2
570 STA TEMP;SAVE CCSR POS
580 LDA $EB
590 STA TEMP+1
600 MOVEIT CLC;WILL MOVE CCSR
610 JSR $C018;CALL PLOT. X=ROW, Y=COL
620 BCS ERR1;IF X & Y INVALID
630 JSR CHKSTR
640 PLA;GET ACCUML
650 BEQ RSTCRS
660 DONEPLOT RTS
670 ERR1 PLA
680 ERREMSG LDA ERRENB;IF ZERO PRINT MESS
AGE
690 BNE DONEPLOT
700 JMP $7D28;ILLQTY
710 ;
720 LINKS CMP #$05
730 BCC LINK2
740 BCS ERREMSG
750 ;
760 RSTCRS LDA TEMP
770 STA $E2
780 LDA TEMP+1
790 STA $EB
800 JMP $C15C;SET POINTERS
810 ;
820 CHKSTR JSR CHRGOT;PRINT ANYTHING?""
830 BEQ DONEPLOT;NO
840 JSR $795C;CHK COMMA
850 JMP $555A;PRT STRING
860 ;
870 FRPRT JSR PRTIT;LEFT EDGE
880 LDY $E6;LEFT COL.
890 INY
900 INX
910 CENT JSR PRTIT+1;CENTER
920 INY
930 CPY $E7;RIGHT COL
940 BNE CENT
950 ;
960 PRTIT INX
970 LDA FRAME,X
980 JMP $C00C;PRINT CHR IN A & RTS
990 ;
1000 LINK2 STX $C3
1010 TAY
1020 LDA #<AREA
1030 LDX #>AREA
1040 CLC
1050 ADC ADDTBL,Y
1060 BCC LINK3
1070 INX
1080 LINK3 LDY $C3
1090 STA $C3
1100 STX $C4
1110 LDX #$1A
1120 TYA
1130 BNE LINK6
1140 LDY #$25
1150 LINK4 DEY
1160 LDA $E0,X
1170 STA ($C3),Y
1180 DEX
1190 BPL LINK4
1200 LDX #$0D
1210 LINK5 DEY
1220 LDA $0354,X
1230 STA ($C3),Y
1240 DEX
1250 BPL LINK5
1260 RTS
1270 ;
1280 LINK6 LDY #$25
1290 LINK7 DEY
1300 LDA ($C3),Y
1310 STA $E0,X
1320 DEX
1330 BPL LINK7
1340 LDY #$0D
1350 LINK8 DEY
1360 LDA ($C3),Y
1370 STA $0354,X
1380 DEX
1390 BPL LINK8
1400 RTS
1410 ;
1420 AREA .BYT 0;EDITOR STORAGE BEGINS

```

PRESERVING 80 COLUMN SCREENS

The memory-moving feature of *TextSave* (January 1988) can be combined with SYS ED to save and recall two 80 column screens. In this way, you could save the screen, open a window, and then recall the screen, replacing what was overwritten by the window.

First, some memory must be set aside in RAM 0 to hold the 4K of each 80 column screen:

GRAPHIC 1: GRAPHIC 0

sets aside 9K of memory beginning to address 7168 normally used for a bit map display. This area will be safe until a GRAPHIC CLR command. The BASIC subroutine to save/recall 80 columns should look something like this:

```
2000 POKE 195,0: POKE 196,SH: POKE 174,  
,0: POKE 175,EH  
2010 SYS TS+236,0,0,D1: SYS ED,S,D2: R  
ETURN
```

Line 2000 sets up the start and end address (+1) in RAM 0 for *TextSave* to move. "SH" is the start address divided by 256 and "EH" is 4096 bytes higher, also divided by 256. In line 2010, "TS" is the start address of *TextSave* and 0, 0, tells the routine to start at address 0 in VDC memory, the normal location of 80 column text. Direction D1 is 0 to move data to 80 column memory and D2 is > 0 to restore screen editor values. To save an 80 column screen, D1 is > 0 and D2 = 0. "S" is the set of editor values. It's up to you to keep track of which set goes with which display.

ML.) The default characters can also be changed by POKEing new codes into SA + 12 through SA + 20 in the order described earlier.

In line 340, SYS 52591 calls a ROM routine to turn on the cursor. This provides a cursor for use with GET or GETKEY as an alternative to INPUT. The cursor is turned off by calling another ROM routine at location 52639 with 32 in the accumulator.

To change the location of editor storage, POKE the low byte and high byte of the storage address into SA + 181 and SA + 183. Each set requires 40 bytes. If error messages are disabled as described earlier, storage can be in RAM 0 above 16383. The computer must be in the BANK 0 configuration in this case, before SYS ED. For the other routines, the C-128 must be in BANK 15 since several ROM routines are used. "AT" and "ED" set the processor carry flag if any values are out of range, so RREG,,SR, immediately after the SYS, reads the status register into SR. IF SR AND 1 = 1 THEN something went wrong.

If error messages are enabled, the TRAP statement of BASIC 7.0 can be used to prevent ILLEGAL QUANTITY from messing up your screen. Note that parameters greater than 255, or strings where numbers should be, cause SYS to return with the appropriate error message regardless of the condition of the Window Dressing error message flag. □ SEE PROGRAM LISTING ON PAGE 69

FLOTSAM

Send your comments on any aspect of Commodore computing to *Flotsam*, c/o *Ahoy!*, Ion International Inc., 45 West 34th Street—Suite 500, New York, NY 10001.

I would like to thank you for the past few years of very good reading. The magazine is well-balanced, with a wide variety of articles. It seems to cover all the different aspects of Commodore computing, not to mention the talented writers. Of course, I do have a complaint or two. I don't feel that the average Commodore user is that interested in COMAL. This section could possibly be used to teach beginners BASIC, ML, everyday commands, etc.

I am an average user who is eager to learn in a non-complicated way (like most people I talk to). Between work and life's other necessities, I don't have the time to study as much as I should, so I like your magazine and its quick tips. Again, thank you for making computing on my C-128 less frustrating and more enjoyable.

—John Burke
Rosedale, NY

We began our COMAL Column because we felt the language had not received the press it deserved. But space, as you indicate, is at a premium. As of the next installment (September), COMAL coverage will cease for the time being.

There is very little software available for the C-128 in its 128 mode, and there appears to be little on the horizon. Therefore, when *Ahoy!* publishes a program for the 128 that uses some of the great characteristics of the machine, 128 owners are naturally very enthusiastic.

I recently read that Commodore had sold one million C-128's. That is a large number for potential sales of software and is generally being ignored by the software houses. However, there is a possible alternative. If *Ahoy!* were to publish a special issue on a yearly basis dedicated only to the C-128, I believe that C-128 owners would feel that they had died and gone to heaven and would make such a venture a huge success. With Blakemore, Rupert, et al, you certainly have the talent to put it over.

—Neal Smith
Rochester, NY

We'd love to do as you suggest, Neal. But remember the Aesop's fable about the man with the donkey? See below.

I first became interested in your mag because of *Tips Ahoy!* As a relatively new Commodore owner, I was hungry for programming hints and tricks. I was satisfied for awhile, but it seems lately you've been allotting an unproportionate amount of space to the 128 user. Please don't assume that just because breakthroughs in computer technology have been advancing at phenomenal rates that all of us 64 owners have been experiencing the same phenomenon with regards to our salaries. Heck, there are a lot of us that haven't even utilized the potential of our 64's yet. I don't think your readers would mind a couple fewer game programs if it meant expanding your more useful columns (i.e., *Tips Ahoy!* and *Flotsam*).

—Tom Rowan
Ft. Wayne, IN

Send your best programming and hardware hints for the C-64, C-128, or Amiga to *Tips Ahoy!*, c/o Ion International Inc., 45 W. 34th St.—Suite 500, New York, NY 10001. Include a stamped and self-addressed envelope.

LET YOUR FUNCTION KEYS ESCAPE

The Commodore 128 has numerous useful and entertaining ESC-key combinations, some of which are so darn good you wonder why Commodore didn't put a specific key for them right on the keyboard. ESC-D, for instance: that one deletes one line on the screen, moving all the text after it up one line. I use it all the time! But I'm lazy, and absolutely hate having to press two keys to do anything. So in the interest of cutting my typing in half:

KEY7,CHR\$(27)+"D"

Now when F7 gets pressed, it does the same thing as an ESC-D. Follow that up with:

KEY8,CHR\$(27)+"I"

and pressing F8 inserts a line. I know, I know, we're back up to two keypresses, SHIFT plus F7, but now they're in the same corner of the keyboard. (And easier to find at 3:00 a.m.!) After all, they're related functions, right? Now try these:

```
KEY1,CHR$(27)+"A"+CHR$(27)+"E" :REM AUTO
INSERT ON, CURSOR FLASH OFF
KEY2,CHR$(27)+"C"+CHR$(27)+"F" :REM AUTO
INSERT OFF, CURSOR FLASH ON
KEY3,CHR$(27)+"V" :REM SCROLL TEXT UP ON
E LINE
KEY4,CHR$(27)+"W" :REM SCROLL TEXT DOWN
ONE LINE
```

Nothing fancy, just some more "related" ESC codes and suggested function keys to store them in. If you really like a particular sequence, you can preserve it forever by typing a line number before the KEY command:

```
1000 COLOR0,1:COLOR4,12
1010 KEY5,CHR$(27)+"T" :REM SET UPPER LE
FT CORNER OF WINDOW
1020 KEY6,CHR$(27)+"B" :REM SET LOWER RI
GHT CORNER OF WINDOW
```

I have a more elaborate version of that little program saved on my main C-128 programming disk, named "KEYS". The first thing I do when I turn on my 128 is type RUN"KEYS" and all my favorite function key combos are restored, along with a pleasing screen color. You can build tremendously elaborate ESC-key combos into the function keys.

—David F. Paulsen
Houston, TX

Compiled by Michael R. Davila

RIPPLES

This short program for the C-64 and C-128 plots several concentric circles in extended background mode, then cycles through the different registers to give the illusion of motion. It takes about five minutes to plot all the circles, so be patient. This is one of those deals where the display looks good, but it's left up to you to find a good application.

—Cleveland M. Blakemore

```
•10 REM RIPPLES FOR THE C-64 OR C-128
•20 V=53248:N=6.3:H=20:W=12:M=19:U=1:L=.5
:K=40:B=1024:J=24:G=64:S=32:OF=54272
•30 PRINT"[CLEAR]":POKE53281,..:POKE53280,
..:POKE53265,PEEK(53265)OR64
•40 POKEV+34,1:POKEV+35,12:POKEV+36,11
•50 E=30/25:C=1:FORR=MTOSTEP-U
•60 FORT=.TONSTEP(U/(R+R)):X=INT(E*R*COS(
T)+H+L):Y=INT(R*SIN(T)+W+L)
•70 P=Y*K+X+B:IFX>.ANDX<KANDY>.ANDY<JTHEN
POKEP,S+G*C
•80 NEXT:C=C+U+(C=3)*3:NEXT
•90 POKEV+34,0:POKEV+35,0:POKEV+36,6
•100 A=PEEK(V+34):B=PEEK(V+35):C=PEEK(V+3
6):POKEV+34,B:POKEV+35,C:POKEV+36,A
•110 FORX=.TO60:NEXT:GOTO100
```

SPLIT FACE

Split Face scrolls half the screen left and the other half right. All character colors are maintained as your screen takes on a split personality. Now you have a clear screen that's ready for your next title, menu, or graphics display.

Append *Split Face* to your own programs and have them run the loader to POKE the data into memory. It works on the C-64 and C-128 in 40 column mode. Whenever you want *Split Face* to drop the hatchet, enter the following:

100 SYS 49152

For the C-128 it would be:

100 SYS 4864

The line numbers are only examples. You can use any line number you want.

To demonstrate, run the loader. Now list the program to fill the screen. Cursor to the top and enter in direct mode (no line number):

SYS 49152

(SYS 4864 for the C-128), then press RETURN. Your characters will split like a knife through butter.

Split Face can be relocated by changing the variable A

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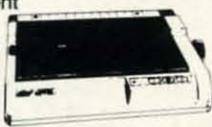
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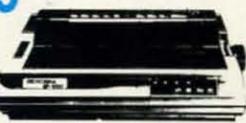
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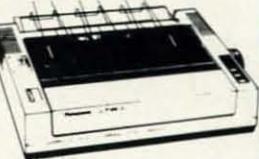
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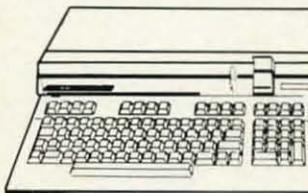
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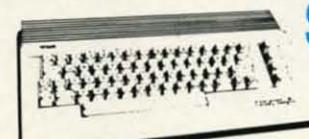
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in line 1. Be sure to SYS to the new address if you do change it.

Buck Childress
Salem, OR

```
•1 A=49152:REM * (A=4864 FOR THE C-128) *  
  (BOTH VERSIONS CAN BE RELOCATED.) *  
•2 FORJ=ATOA+95:READB:POKEJ,B:X=X+B:NEXTJ  
•3 IFX<>17061THENPRINT"ERROR IN DATA[3]."."  
  ]":END  
•4 REM *** YOU COULD PLACE A RETURN HERE  
  IF THIS IS USED AS A SUBROUTINE. ***  
•5 DATA169,20,133,250,169,0,162,4,160,216  
  ,133,251  
•6 DATA133,253,134,252,132,254,162,24,160  
  ,38,177,251  
•7 DATA200,145,251,136,177,253,200,145,25  
  3,136,136,192  
•8 DATA20,176,239,160,20,169,32,145,251,1  
  60,1,177  
•9 DATA251,136,145,251,200,177,253,136,14  
  5,253,200,200  
•10 DATA192,21,144,239,160,19,169,32,145,  
  251,165,251  
•11 DATA24,105,40,133,251,144,2,230,252,1  
  65,253,24  
•12 DATA105,40,133,253,144,2,230,254,202,  
  16,181,160  
•13 DATA10,202,208,253,136,208,250,198,25  
  0,208,153,96
```

SURVEYOR

1000 screen and 1000 color RAM locations! Now just how are we as mere mortals supposed to look at the monitor and know exactly where each one is? If you're trying to POKE characters and colors to various locations, it can quickly become hair-pulling time.

You can always use the chance method. Throw darts at the monitor from 10 paces and figure that's close enough. Trouble is, they don't stick too well. And, if they do, you'll wind up with an air-conditioned screen.

Take heart. There is a better way. And it's 100% accurate. *Surveyor* instantly gives you the screen and color RAM locations of any place you choose. Let's give it a whirl.

First load and run *Surveyor*. To activate it, type SYS 49152 and press RETURN. Now you can survey the situation.

Just cursor to a desired target and press the SHIFT and CONTROL keys at the same time. Two numbers will appear. The first is the screen RAM location and the second is the color RAM location. Try it again. Nice and easy, nice and quick.

Surveyor can easily be relocated if you want. Just change the variable A in line 2 to your new starting address. Don't forget to SYS there if you do.

RUN STOP/RESTORE deactivates *Surveyor*. SYS to the appropriate address to reactivate it.

Don't pull your hair out. But, if you do, maybe you can sell it for a toupee.

Buck Childress
Salem, OR

```
•1 REM *** SURVEYOR C-64 ***  
•2 A=49152:PRINTCHR$(147)  
•3 FORJ=ATOA+95:READB:POKEJ,B:X=X+B:NEXTJ  
•4 IFX<>14696THENPRINT"ERROR IN DATA[3]."."  
  ]":END  
•5 C=INT(A/256):D=(A-(C*256))+13:POKEA+1,  
  D:POKEA+3,C  
•6 PRINT"DATA OK * SYS"A"TO ACTIVATE[3]."."  
  ]":END  
•7 DATA169,13,162,192,120,141,143,2,142,1  
  44,2,88  
•8 DATA96,173,141,2,166,254,133,254,201,5  
  ,208,69  
•9 DATA228,254,240,65,169,1,133,204,165,2  
  11,133,252  
•10 DATA165,214,133,253,165,209,166,210,2  
  4,101,252,144  
•11 DATA1,232,134,251,170,165,251,32,205,  
  189,169,42  
•12 DATA32,210,255,165,243,166,244,24,101  
  ,252,144,1  
•13 DATA232,134,251,170,165,251,32,205,18  
  9,166,253,164  
•14 DATA252,24,32,240,255,169,0,133,207,7  
  6,72,235
```

FASTER CHARACTERS IN BASIC 7.0

The following program redefines the character set in only two seconds. A FOR/NEXT loop would take 32 seconds.

Lines 50 and 60 move the character ROM into the bit map screen. The monitor is called via a function key.

Lines 80 through 110 give you underlined letters. To access them, press the letter keys with the logo key. The effect is much better if you use capitals in line 80.

The next 12 lines are for simple animation. Circles are drawn on one character then copied to the space character.

—James Glaser
Burney, CA

```
•10 COLOR 0,1:COLOR 1,4:COLOR 4,1  
•20 GRAPHIC 1,1:GRAPHIC 0,1:BANK 15  
•30 PRINT "[HOME][HOME][3"[DOWN]]]"TAB(15  
  )"WORKING[3]."."  
•40 WINDOW 0,13,39,24,1  
•50 KEY 1, "[CLEAR][BLACK]MONITOR"+CHR$(13  
  )+"T ED800 ED[3" F"] E3800"+CHR$(13)+"X"+  
  CHR$(13)+"GOTO70"+CHR$(13)  
•60 POKE 209,PEEK(4096):POKE 210,0:END  
•70 KEY 1,"GRAPHIC":GRAPHIC 2,0,13:COLOR  
  5,14  
•80 TEXT$="<->.* [s K][s I][s T]=[s G]+[s  
  M]!"+CHR$(34)+"[s N][s Q][s D][s Z][s S  
  ][s P][s A][s E][s R][s W][s H][s J][s L  
  ][s Y][s U][s O]?[s F][s C][s X][s V][s  
  B]"  
•90 POKE 4588,216:CHAR,19,21,TEXT$  
•100 FOR A=91 TO 127:R=14343+A*8
```

Continued on page 82

THEY-DO-RUN-RUN-RUN- THEY-DO-RUN-RUN

By Richard Herring

Speed. Raw, blinding, power-user speed. Amigas running anywhere from 7.14 megahertz to over 14 MHz with turbo boards sharpening the cutting edge.

How can the poor C-64 keep up at a piddley 1 MHz? Or even the C-128 in fast mode at a dawdling 2 MHz? But obviously they do keep up, as is evidenced by some of the fine and very powerful software available.

For a given computer, speed can be significantly enhanced by two things: programmer's tricks and programmer's tools. Tricks come with experience. Tools are equally available to all of us—often off the shelf.

One key tool is the language in which we each choose to program. Several of you have asked just how fast COMAL is. Forget for the moment how its structure enhances programming and debugging. If COMAL is not at least as fast as other languages, then it's not what some of you power programmers are looking for.

Enter Herbert Denaci, engineer and speed aficionado. While I was doing some of the background work on this column, he and I exchanged a few letters. Denaci has done exactly the kind of speed testing that will be useful in proving COMAL's value. So we'll explore his benchmarks, as well as a few others, and you can judge COMAL for yourself.

Denaci's Benchmarks—C-64 or C-128 at 1 MHz

(Scores are ranked against BASIC 2.0. A score of .50 means the benchmark ran in half the time BASIC took.)

	Sieve	Trig	Flight	Ahl's
COMAL 0.14	.74	1.00	.69	.97
COMAL 2.0	.30	.98	.54	.22
BASIC 2.0	1.00	1.00	1.00	1.00
BASIC 7.0	1.46	1.08	1.28	1.09
Pascal (Oxford)*	.14	1.05	.67	.55
PROMAL*	.06	1.13	.86	1.45

*The "run" times for Pascal and PROMAL do not include the separate step of compiling the source code. Compile times vary from 7 to 94 seconds on these benchmarks, which run in anywhere from 1/2 to 5 minutes.

Now no benchmark gives an absolutely true picture

of a language's speed. What you want as a programmer is the most speed for the particular program you're writing right now. The useful speed of the language will change as the demands of your program vary. All a benchmark can do is provide a comparison based on the features it happens to exploit.

Let's look first at the Sieve of Eratosthenes. It has been used as a programming algorithm since at least 1969. All it does is find prime numbers. Sieve is generally used to test a high-level language's performance in Boolean algebra. It also gives an indication of the language's abilities in array handling, memory references, and structured control statements.

The heart of Denaci's translation of Sieve, into COMAL 0.14, is:

```
0130 FOR I#:=0 TO SI# DO
0140 IF FLAGS#(I#) THEN
0150 PRIME#:=I#+I#+3
0160 K#:=I#+PRIME#
0170 WHILE K#<=SI# DO
0180 FLAGS#(K#):=FALSE
0190 K#:=+PRIME#
0200 ENDWHILE
0210 COUNT#:=+1
0220 ENDIF
0230 ENDFOR I#
```

Sieve has a lot of calculations to perform. Writing it this way allows it to be a real screamer because: 1) it doesn't use division, 2) it uses prior knowledge about numbers that cannot be primes (even numbers), 3) it already knows that 0, 1, 2, and 3 are the first four primes, and 4) it calculates primes as the value of the variable PRIME#, or twice the current array index plus three.

To stretch out the test a little, a major loop is run 10 times with these additional lines:

```
0080 DIM FLAGS#(0:SI#)
0090 FOR ITER#:=1 TO ML# DO
0100 FOR I#:=0 TO SI# DO FLAGS#(I#):=TRUE
0110 PRINT "LOOP ", ITER#
0120 COUNT#:=0
```

```
0240 ENDFOR ITER#
0250 PRINT "COUNT="; COUNT#
```

Denaci's Benchmarks—C-128 at 2 MHz

(Scored against BASIC 2.0)				
	Sieve	Trig	Flight	Ahl's
COMAL 0.14	.73	1.03	.78	.97
COMAL 2.0	.30	1.00	.60	.22
BASIC 2.0	1.00	1.00	1.00	1.00
BASIC 7.0	1.38	1.21	1.35	1.04
FORTRAN (Nevada)*	—	5.70	2.84	1.60

*The run times for FORTRAN use the C-128's Z80 microprocessor and do not include the separate compile times.

Denaci's calls his second benchmark Trig. It uses trigonometry functions that are typical of those used in flight dynamics problems. The heart of this benchmark, in COMAL 0.14, is:

```
0100 ITERATION:=0
0110 A:=.1
0120 B:=.2
0130 FOR ITERATION:=1 TO 1000 DO
0140 C:=SIN(A/B)*COS(A/B)
0150 ENDFOR ITERATION
```

The Trig benchmark is just a warmup for Denaci's real interest—the Flight Dynamics Simulation benchmark. He

TECH NOTES

1) The COMAL Users Group claims version 2.0 is about twice as fast as 0.14. *COMAL Today* magazine #6, p. 17.

2) All the C-128 benchmarks were run in C-64 mode. COMAL 0.14 won't load in C-128 mode and the COMAL 2.0 cartridge forces the C-128 into C-64 mode on bootup.

3) If you own a C-128, you can kick your computer into its fast speed while in the 64 mode. Normally the C-128 in 64 mode operates with a 1 MHz clock, but you can switch to the 2 MHz clock with POKE 53296,3 and reset to 1 MHz with POKE 53296,0. In the faster speed, the C-128 screen will go blank and internal computer operations will click along at twice the normal speed. (The corresponding hex address to 53296 is \$D030.) You can elect to just blank (not erase) the screen and take the modest speed improvement by POKEing 53265 with a 3 (off) and then a 0 (on).

4) The Sieve benchmark has been written other ways using division. It runs dozens of times slower. The moral? If you're looking for speed, don't throw out high-level languages; look for better algorithms. High-level languages are generally considered to save time in development and debugging. If you just have to have

wrote this 145-line benchmark to be representative of a guided missile program used for design studies. It's not listed here for space reasons—not physical space, but the space that appeared between my ears when I attempted to decipher it. Suffice it to say that Flight contains plenty of arithmetic calculations as well as all the trigonometry you could hope for.

Dropping back in time to another old benchmark, we find David Ahl's Simple benchmark from the January '84 issue of *Creative Computing*. Translated into COMAL 0.14, the meat of this test looks like:

```
0100 R:=0
0110 S:=0
0120 FOR N#:=1 TO 100 DO
0130 A:=N#
0140 FOR I#:=1 TO 10 DO
0150 A:=SQR(A)
0160 R:=+RND(1)
0170 ENDFOR I#
0180 FOR I#:=1 TO 10 DO
0190 A:=A^2
0200 R:=+RND(1)
0210 ENDFOR I#
0220 S:=+A
0230 ENDFOR N#
```

This benchmark tests for mathematical accuracy by taking the square root of A, then squaring the result and adding it to the variable S. Perfect accuracy would result in S equaling 5050 at the end of 100 cycles through

more speed in your finished program, try rewriting the most critical routines in assembly language. Even then, don't throw out that high-level code—it may be useful documentation in the future.

5) Ahl's benchmark is, like the others, designed to give a specific comparison of processing speed. However, it also reports on the accuracy of the language and the computer at squaring the square root of a number and coming up with exactly the original number. At the end of the completed benchmark, it subtracts the original number from the one calculated by the computer. Presumably the closer to zero the better. Here are some interesting "accuracy scores":

COMAL 0.14	0.000298	COMAL 2.0	0.000117
BASIC 2.0	0.001041	BASIC 7.0	0.001052

6) No benchmark can be the sole criterion for you to use in judging a language. Sieve, for example, does not test features like recursion or sets, which are critical to some programming tasks. And benchmarks totally fail to show ease of programming. As Denaci wrote, "In comparing the five languages, there is no doubt that COMAL is superior, it is user friendly! BASIC isn't as difficult as the 'compiled' languages,

the major loop. And the benchmark exercises the random (RND) function by adding a random number between 0 and 1 to the variable R a total of 2000 times. That's 10 times (line 140) plus 10 times (line 180) multiplied by 100 (line 120). The resulting value of R, based on probabilities, should be 1000, but the actual calculation doesn't mean much with the exception of testing execution speed.

Rupert's "Benchmarks"

(Scored against BASIC 2.0)

	Addition (1 MHz / 2 MHz)	Multiplication (1 MHz / 2 MHz)
COMAL 0.14	1.07 / 1.06	1.05 / 1.04
COMAL 2.0	.64 / .64	.77 / .77
BASIC 2.0	1.00 / 1.00	1.00 / 1.00
BASIC 7.0	1.42 / 1.39	1.29 / 1.26

Next we'll borrow from the *Rupert Report* in the June 1987 issue of *Ahoy!* that showed BASIC's ability to perform 1000 additions or multiplications. Dale's test, converted to COMAL 0.14, is:

```
0100 A:=3.21896543
0110 B:=1.02104539
0120 POKE 160,0
0130 POKE 161,0
0140 POKE 162,0
0150 FOR N:=1 TO 1000 DO
0160 A:=A+B // ++ A:=A*B
0170 ENDFOR N
```

but it has the limitation of only recognizing the first two letters in variable names. Using compilers makes it difficult and time consuming to troubleshoot and edit a program."

7) If you choose to run these benchmarks yourself, you can get more accurate timing than is possible with a sweep-second hand or by counting one-thous-and-and-one. Use the computer's internal clock. If the language does not have a way to directly access the clock, like BASIC's TI\$ or COMAL 2.0's TIME, then use zero-page memory locations 160-162 (\$A0-\$A2). POKE them with zeros just before the main body of the benchmark and calculate the time at the end with:

```
PRINT (256*256*PEEK(160)+256*PEEK(161)
+PEEK(162))/60
```

8) For more reading on benchmarks, try: "Leaks Like a Sieve," *Byte*, 8/85, p. 33; "Benchmarks," *Byte*, 8/85, pp. 132-3; Gilbreath, J., "A High-Level Language Benchmark," *Byte*, 9/81, pp. 180-198; Knuth, D., *The Art of Computer Programming Vol 2: Semi-Numerical Algorithms*. Reading MA: Addison-Wesley, 1969; Ahl, D., "Creative Computing Benchmark," *Creative Computing*, 1/84, p. 5.

```
0180 PRINT (256*256*PEEK(160)+256*PEEK(161)
+PEEK(162))/60,
0190 PRINT " SECONDS"
```

Finally, let's return to Son of Sieve and I'll get around to answering Robert Boomers' question about COMAL's speed. He sent the following BASIC program that computes the first 1000 prime numbers.

```
10 TI$="000000":DIM Y%(8000):P=1:C=0
20 PRINT P,:C=C+1:IF C=1000 THEN 50
30 P=P+1:IF Y%(P)=1 THEN 30
40 FOR X=PTO8000 STEPP:Y%(X)=1:NEXT:GOTO 20
50 PRINT:PRINT TI/60
```

Translated into COMAL 2.0, Boomers' benchmark reads:

```
10 TIME 0
20 DIM Y#(8000)
30 p:=1; c:=0
40 REPEAT
50 PRINT p;
60 c:=c+1
70 REPEAT
80 p:=p+1
90 UNTIL Y#(p)<>1
100 FOR x:=p to 8000 STEP p do
110 y#(x)=1
120 ENDFOR x
130 UNTIL c=1000
140 PRINT TIME/60
```

Boomers sent in times for BASIC 7.0 (1 MHz) and Abacus BASIC (MHz unknown), to which I've added a few:

Son of Sieve

	1 MHz	2 MHz
BASIC 7.0	266 seconds	127 seconds
BASIC 2.0	209 seconds	102 seconds
COMAL 0.14*	197 seconds	95 seconds
COMAL 2.0	99 seconds	48 seconds

*COMAL 0.14 is short on program memory (under 10K), so times are estimated based on a benchmark to find the first 725 primes.

**This "run" time does not include the extra step of compiling the program.

So, what do all these numbers mean? You're free to draw your own conclusions. To me they say that COMAL 0.14 is often an improvement over BASIC (in speed, that is; in other ways, it's always an improvement). And COMAL 2.0, depending on your programming application, can have your C-64 running at C-128 "turbo" speeds. You're free to draw your own conclusions. Let me know what they are at P.O. Box 1544, Tallahassee, FL 32302. □

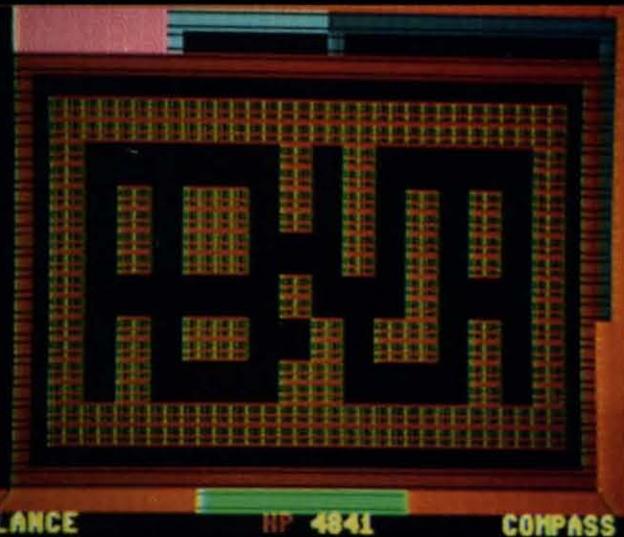
TOMB OF HORROR

The Ultimate 3-D Adventure for the C-64
By Cleveland M. Blakemore

At the farthest corner of the earth, beyond the barren wasteland, lies the Tomb, abode of the hideously evil Demon King and the hordes of darkness. The Demon's greatest treasure is the Alchemy Stone, an artifact from the ancient world that transmutes matter itself.

Your task is to retrieve the Alchemy Stone (along with all the treasure you can gather) from the nether regions and escape from the *Tomb of Horror* into the light of day.

This is the third (and final) entry in my trilogy of 3-D games. It evolved out of *Crypt of Fear* (Feb. '88 *Ahoy!*), which in turn was inspired by *Vault of Terror* (Oct. '86 *Ahoy!*). I like to think I've outdone myself, but you will ultimately be the judge of that.



This game is a real-time three-dimensional dungeon adventure that utilizes page-flipping animation, multiple sprite shapes, pull-down windows with joystick-controlled menus, and thirteen different creatures. It has three separate levels, five different kinds of traps, nine different types of weapons, five types of armor, and thirty individual objects that can be held, examined, or used in some way. It also features high quality graphics in color, thanks to extended background mode. The game has complex algorithms for combat, taking into account the type of creature you are fighting, the type of armor you have on, what type and quality weapon you are using, and how strong you are as a fighter.

In order to squeeze this program into a measly 68 blocks on disk, I had to throw all frills to the wind. Although it



originally had an attractive title screen and a redefined character font, I had to take these out because of space limitations. In order to assure that the program quality did not suffer one iota, I also had to keep the sound effects to a minimum. I doubt if these deletions will be missed. (Ed. note: the July *Ahoy!* Disk contains an expanded version of *Tomb of Horror*, complete with redefined graphics and enhanced title screen. See page 52 for ordering information.)

The program is entirely joystick operated. You will never have to touch the keyboard after typing RUN. All commands are entered through a convenient system of pull-down



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menus that erase themselves after use. The commands are simple and straightforward, requiring very little explanation.

To move forward in the dungeon, push the joystick forward. The word "MOVE!" will appear at the bottom of the screen, there will be a slight pause, and you will be standing one block forward from where you were. To turn left, move the joystick left. To turn right, move the joystick right. To move back, pull the joystick back.

If the block you are standing in has anything in it, the bottom line of the screen announces it at the left. If there is a monster in the block with you, the bottom line tells you at the far right.

To access the main menu, you must be standing in a block not occupied by a monster. To pull the menu down, push the fire button and simultaneously pull back on the joystick. The menu appears in blue on the screen, with a selection of thirteen commands to choose from. No creature can attack while you're in the menu.

You can move from one selection to another by moving the highlighted choice in white with the joystick. Push the fire button to select.

The thirteen commands in the main menu are TAKE, DROP, LEFT HAND, RIGHT HAND, ARMOR, ASCEND, DESCEND, EXAMINE, INCANT, QUAFF, SEARCH, INVENTORY, and EXIT MENU. The last erases the main menu window and returns you to real time adventure in the dungeon. Otherwise, you can push the fire button whenever you are finished reading a message or looking at a sub-menu display window, in order to close it and return to the main menu.

TAKE and DROP allow you to pick up and dispose of objects for your inventory. TAKE automatically picks up whatever is in the block with you, providing you do not already have one. DROP allows you to select from one of the four classes of objects you can carry, which read on the sub-menu as WEAPON, ARMOR, SPECIFIC ITEM, and TREASURE. The last entry is EXIT MENU, in case you change your mind and need to escape from the sub-menu.

LEFT HAND allows you to locate a weapon from your inventory and place it in your left hand, your fighting appendage. RIGHT HAND allows you to hold an object from the SPECIFIC ITEMS menu of your possessions. ARMOR permits you to select what you will be wearing. Remember, if you have not selected it from the menu, you are empty handed, no matter what you may be carrying. It is possible to be beaten to death by a flying bat if you have a bazooka in your inventory but have not placed it in your left hand so that you can fight with it.

These commands are very versatile, and many of them are interrelated. You must be holding the compass, for instance, in order to know what direction you are facing.

ASCEND and DESCEND allow you to do just that, if you come across a shaft. You'll need a rope and a steel grappling hook before you can climb up or down.

EXAMINE is also a very versatile command, which you use to look closely at an object in the inventory. You can compare weapons and armor and see which is of better quality. For example, although common sense might dictate that a hand axe would be a better weapon than a dagger, a dagger of excellent workmanship would probably be superior

to a hand axe of mediocre or common workmanship. It is left to the discretion of the adventurer. Other objects can also be examined, with various results. I'd like to leave secrets for the player to discover, rather than spoil the fun.

Anything that can be held in the right hand can be INCANTED, which means calling upon its mystical or arcane properties. Don't expect much from INCANTING a compass, but you might try INCANTING suspicious items like the mithril ring (assuming you are in the right locations). INCANT has different effects, depending on the artifact.

QUAFF means to take a swallow of healing elixir, which you carry in one pint servings. It gives you strength for battle and may save you life at an opportune time.

SEARCH looks for traps four blocks forward of your current location. Use this command frequently, or you'll find yourself falling into spiked pits, getting impaled on spears, and becoming tangled in tripwires. Your adventure will be cut short quickly if you are not cautious.

INVENTORY prints out four windows displaying everything you have.

Remember, your long-term goal in the *Tomb of Horror* is to acquire the Alchemy Stone, and all the options on the menu can assist you toward this end one way or another.

Once you have obtained the Alchemy Stone, return to the surface world by ASCENDING through the shaft on the first level in the far northwest corner, and win the game.

I'm certain the game will provide you with hour after hour of entertainment. The quickest game I've played successfully required 45 minutes to get the Stone and return to the upper level.

The whole window system used in *Tomb of Horror* would not be possible without the use of Shawn K. Smith's clever memory move command from the June '87 *Tips Ahoy!*, which uses the built-in ROM routines to stash and save text and color information in a buffer above BASIC memory set aside for the purpose. My thanks to Shawn for the use of his short ML tip.

The game is in two parts: a BASIC section and a binary file. Be certain that the *Flankspeed* file is named correctly so that the main program can load it into memory.

Tomb of Horror contains numerous shifted spaces which must be typed in correctly, because the program uses extended background mode and requires shifted characters to generate different colors. Be especially careful when typing in the game.

Giving credit where credit is due, I'd like to pay tribute to the game *Dungeons of Daggorath* for the Tandy TRS-80 as the driving force that compelled me to create my own 3-D games for the C-64. Ever since I saw this game back in the summer of 1985, I've been striving to create a 3-D game as good or better.

If you think I succeeded, or failed miserably, please let me know. I sincerely enjoy reading mail, both critical and flattering, and would like to hear what all *Ahoy!* readers think of *Tomb of Horror*, or any other games I've created in the past. Hearing the voice of the readers gives direction to my efforts. If you would really like to see "just one more" 3-D game, or hope I'll never waste so much magazine space again, let me know, c/o *Ahoy!* You might see one of your suggestions incorporated into a game in the future! □ SEE PROGRAM LISTING ON PAGE 72

ENTERTAINMENT SOFTWARE SECTION

Continued from page 23

an aircraft carrier! Better still, *Jet* interfaces with the entire library of *FS* Scenery Disks (as does this new program), so computer pilots can wage contemporary high-speed air combat over just about any city on Earth.

Stealth Mission, written by Steve Setzler and "directed" by Bruce Artwick, represents the latest wrinkle in the ongoing saga of the software Icarus. Unlike *Jet*, it does not contribute a quantum leap forward in terms of design. Technologically, however, it pushes the Commodore 64/I28 envelope well beyond the blue horizon, to a whole new level of animation and frame rates.

The visual integrity in all cockpit displays is absolutely incredible. The program never freezes in order to load new data, but rolls smoothly with the exception of occasional color flip-flops.

The emphasis here is not so much on the simulation as on the flight and combat elements. The fact is, the aircraft being simulated here—F-19 Stealth Fighter, Navy F-14 Tomcat, and the experimental forward-swept wing X-29—could probably be flown by chimpanzees. These aircraft do everything but reproduce themselves. SubLOGIC made the design almost idiotproof. Single button commands allow the fighters to locate and rendezvous with a refueling plane. There's even an auto-landing feature. All this flight lacks is Coca-Cola in the cockpit.

Stealth Mission offers eight scenarios, selected from an onscreen menu. These missions range from easy to intermediate to advanced, and include a mountain conflict, a battle at sea, a marathon bomber scenario, and a visually appealing mission in which the air combat occurs over a collection of ancient ruins.

A second screen allows the user to set difficulty (0-9), select an aircraft, and choose its armament (Sidewinder, Sparrow, and Maverick missiles, four kinds of bombs, AGM-84 Harpoon, air-to-air and air-to-ground Stealth missiles, and an M61 cannon).

Instrumentation includes all the standard items (HUD, air speed indicator, altimeter, fuel level, thrust, clock, brake and landing gear status, altitude indicator, etc.). There are also navigational aids (ADF receiver and bearing indicator, VOR receiver and omnibear-

ing indicator, DME and ILS glide-slope needle) and weapons/defense controls (damage indicator, radar, target-tracking computer, ECM, weapons select, etc.).

The controls will seem immediately familiar to anyone who's ever used a flight simulator (or, heck, even a real jet): throttle, elevator, aileron controls, airbrakes, landing gear, etc. *Stealth Mission* also allows for joystick control of flight operations.

In addition to the standard *FS/Jet* options (multiple viewpoints, zoom, control tower view, spotter plane), this program adds a "missile's eye view" to intimately track the killer projectiles as they zoom toward a computer-locked target.

Is *Stealth Mission* exciting? Yes, but not as exciting as it should be. The problems are almost intrinsic to the crafts being simulated. They are easy to fly and the onboard computers stabilize them quickly when danger approaches. As a result of all this convenience, the player doesn't have much to do for long stretches of time. The upside, of course, is that users are free to concentrate on combat. However, these air battles have a cold, somewhat antiseptic feel. Instead of simply lining up a target in your sights and blasting away, the computer must be locked on before a weapon is discharged, and that won't happen until the target is within range.

The weaponry is impressive as all getout, with a choice of 11 different missiles, bombs, and cannon, but the results are less than satisfying.

With all the visual marvels SubLOGIC produced for this game, it's a shame more time wasn't spent simulating the results of the warfare. Explosions are nothing special, from either a visual or audio perspective, and we aren't even treated to the sight of an enemy aircraft crashing in flames!

The overall package, however, is excellent. The game comes with maps, extensive and well-written documentation, and a quick-reference card. *Stealth Mission* is an incredible programming accomplishment that deserves (and will doubtless have) the attention of anyone interested in the state of the combat flight simulation art.

SubLOGIC Corp., 713 Edgebrook Dr., Champaign, IL 61820 (phone: 217-359-8482). *—Bill Kunkel*

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geoCALC 128
Berkeley Softworks
Commodore 128
Disk; \$69.95

Berkeley has been busy evangelizing the Commodore world on the benefits of their Graphic Environment Operating System (*GEOS*). Part 2 of that mission has been to provide a bevy of applications which utilize the power of the icon. With that in mind they have released a series of C-128 products which take advantage of the machine's inherent advantages over the 64.

One of those releases is *geoCalc 128*, the graphic interface spreadsheet which accepts worksheets produced by its C-64 counterpart. This copy protected disk requires *GEOS 128* version 1.2 or later, a 128, an 80 column RGB monitor, a joystick or a mouse, and a disk drive (1541 or 1571).

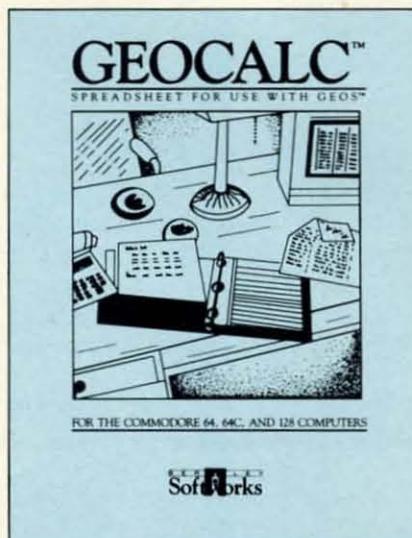
Optional equipment includes a printer, a second disk drive, and a 1750 RAM Expansion Unit (REU). Everyone understands the benefits of a printer and a second disk drive—hardcopy and increased file efficiency—but the REU is another matter. With it, spreadsheets recalculate faster, and larger spreadsheets are possible; therefore less time is spent waiting. That's the whole reason for using computers in the first place.

The Basics

Though copy protected, the application provides a way to make backup copies, the actual work disks. As with most things *GEOS* it is usually best to stay with the routines provided on the disks, whether you're duplicating entire disks or merely copying files.

gC allows a worksheet of up to 256 rows by 112 columns for a cell capacity over 28,000. It provides 12 digit accuracy for addition, subtraction, division, multiplication, and percentage calculations, and 9 place accuracy for trigonometric, exponential, logarithmic, and financial (present/future values, etc.) operations. Up to 200 characters can reside in a single cell.

Almost half of the menu options have keyboard alternatives; the screen display is logical and well-executed.



Useful for light duty jobs at best.
READER SERVICE NO. 177

Cell widths can be changed from 3 to 31 characters, with 12 being the default. Relative and absolute references are supported, as are named ranges and the ability to copy, cut, clear, or paste data (and functions) within a sheet.

Just over a dozen display formats are available (\$0.0, 0.00, 0.0000, for example); and information can be imported or exported to other *GEOS* applications via the scrap function. Alphanumeric alignment functions include centering in a cell, and left or right justification. Character attributes can be displayed and printed as italic, bold, bold-italic, or plain.

Advanced Features—Somewhat

geoCalc 128 handles functions such as ATAN (arctangent), COS (cosine), LOG (logarithm), RAND (random), SIN (sine), SQRT (square root), and TAN (tangent), among others. These, and the other 16 functions, represent the best the program has to offer, mathematically speaking.

gC does make use of the 128's uniqueness—somewhat. The numeric keypad is supported; likewise, its ENTER key functions the same as the RETURN key. The individual cursor keys work, but the function keys are sorely neglected. So is the NO SCROLL key and the HELP key. (There is no online help, and judging from the condi-

tion of my manual, there should be.)

The ability to access an REU's extra memory is excellent, however, as are the numerous ways (five!) to move the cursor about the worksheet.

Entire rows or columns can be selected by clicking on the row or column's alphabetic or numeric label. That is, all the cells in column B can be highlighted (ranged) by moving the cursor over the "B" and clicking the left mouse button. The same applies to numeric rows.

Manual Amnesia

The Dr. Jekyll/Mr. Hyde mix continues as the manual covers both the 64 and the 128, with 128-specific info noted in highlighted boxes. But all the screen illustrations, and there are plenty, are from the 128 version.

Chapter 3 is a tutorial of sorts. Chapter 4 continues the process in greater depth until, in my manual anyway, page 4-6 is reached. That's where Chapter 4 ends abruptly. Full explanations of the "advanced" functions and other bits of information are supposed to be on pages 4-7 to 4-41, give or take a page or two. (Supposed existence of the other pages was revealed by scanning the index for the whereabouts of information concerning the trigonometric functions.)

An outright error is displayed in the screen graphic on page 4 in Chapter 3. A call-out arrow points to the checkmark entry icon, calling it the text entry cursor. The cursor is nowhere to be found, further confusing the issue and making it more difficult to determine the true state of affairs.

Other Anomalies

Some functions are only available via the keyboard, a strange turn of events considering the entire reason this program exists—a graphic interface with icons and pulldown menus.

One such option is the cancel command, useful to abort an incorrect procedure or calculation; the other facilitates marking large chunks of cells for range manipulations. Both are important by any standards.

The fact that there are two data win-

dows available is nothing new either. Many spreadsheets have the ability to split a display into an active and an inactive window, and then scroll through the active one. *gC* only allows horizontal splits—that's like building half a house.

To install *geoCalc 128* with a 1571 drive, the software resets it to act as a 1541. While the procedure is noted in the manual, the need for this kind of manipulation lends credence to the belief that *gC 128* is nothing more than a warmed over *gC* for the 64. That would be okay if all of the 128's unique features were addressed, but they're not.

The program is described as being "intelligent," a phrase usually reserved for spreadsheets which use a sparse memory matrix to recalculate only cells containing entries. This method produces faster results; however, it is not supported by *geoCalc 128*. Nowhere is the term "intelligent" properly described or explained.

After making a big to-do about the high quality of the printed output, it seems strange that the Apple Laser-

Writer is not supported. After all, several other *GEOS* products include drivers for this standard setting printer. Lack of a device driver for this high-end printer muddies the water over the true level of the program's "presentation" quality printing.

How Does It Add Up?

geoCalc 128 is a fine concept, but it has very little mathematical muscle. It cannot import other spreadsheet files (beyond those from the C-64 *geoCalc*); it does not support truly advanced features and functions (macros, conditional searches, etc.); and the manual is erroneous and incomplete.

Its prime attraction is *GEOS*'s graphic, intuitive interface. This "window on the world" provides extreme ease of learning, a comfortable feeling if you're already familiar with *GEOS* programs, and ease of use.

Unfortunately, in this case, that is not enough. Mice, pulldown menus, and icons do not make a program; they are merely tools which drive or feed an application. The software must do some-

thing substantial, must provide a cost-effective solution to a need. In those regards, *geoCalc 128* is not much more than a pretty face. At best, it is useful for light duty jobs.

Berkeley Softworks, 2150 Shattuck Avenue, Berkeley, CA 94704 (phone: 415-644-0883).

—Ted Salamone

TISAR 128

CW Data Labs

Commodore 128

Disk; \$89.95

The first thing you should understand about *TISAR 128* is that *TISAR* is an acronym that stands for Total Information Storage And Retrieval. Having that as its name and its apparent goal, you'll probably guess that it is a database. More than that, however, it is a database that has been optimized for small business use—one that will create and print point-of-sale invoices, database records with monthly or yearly totals of accounts received and receivable, and a perpetual inventory based on sales.

As such, it is one of the most powerful programs I've seen for the C-128, even though it will not have an audience as large as would be the case with a "free-form" relational database.

And for those who may despair because they've been told graphics are all but impossible in the C-128's 80-column mode, we'll point out that *TISAR 128* uses them almost to a fault: simple graphics, true, but eye-catching, as is their intent.

Although it is possible to pick one or another section of *TISAR 128* and use it exclusively, the heart of the system as designed is the database. Since we must use the Commodore 1571 disk drive with double-sided disks, it is possible to install the database program and up to 500 records on a single disk. (Almost necessary for efficiency, since *TISAR* supports only one drive.)

Depending upon whether your business is sales/service or sales/marketing, you'll pick the appropriate program for the job. *TISAR 128* supplies you with two service disks and one marketing disk. With no ability to edit or customize database fields, it is important that variations are provided, but you may still have to bend your current record-keeping methods to fit.

Fields provided are for name, address, phone, part number, remarks,



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An open letter to the readers of Ahoy

Richard Olsen

President: The Ennon Corporation

My purpose in writing is to ask you to join me in shaping the future of the new and most unusual field in computer technology today: Artificial Intelligence.

This incredible power and spectacular creative potential are available to you, for your computer right now. However, there is an alarming possibility that such amazing technology which you have every right to, may not be available to you other than through this offer.

This is unfortunate but somewhat understandable due to the way technology is created. You see, only the business oriented corporation can finance research. It therefore is in a position to dictate immediate research goals. These goals are increasing profits through more efficient production. While valid, they are merely creative and do absolutely nothing to foster exploration in a new applications. The results: technology is never used to its fullest potential. But what's worst of all is that these competitive corporations have absolutely no desire to share technology with each other, let alone with you. So, they don't. As a result, the infinitesimal amount of technology that finally trickles down to you is:

- A. So expensive you are prohibited from procuring it
- B. Shamefully inferior to the real thing

remember...you can buy high-tech consumer goods, but never the technology that creates it.

This same situation confronts you in the new Artificial Intelligence field, but with a difference: There is no *true* Artificial Intelligence for the home computer user! The few programs claiming to be Artificial Intelligence are really simulators. They are not the real thing. Possessing a mere token of the power and versatility, simulators are clearly not worth their expensive price.

I have tried repeatedly to convince my colleagues that it is in their best interest to release genuine Artificial Intelligence to the general public. The refinement, modification and adaptation as individuals create new applications would improve Artificial Intelligence tremendously.

This would benefit *everyone* in the long run.

I have met with little success. Apparently, it seems that immediate corporate profit is more important than sharing technology with the public. Therefore, the Ennon Corporation stands alone in offering superior Artificial Intelligence programming directly to the home computer enthusiast.

Announcing AN-83: The "Thinking" Program

Believe me when I say AN-83 is the real thing. It is a true "thinking" program that receives an initial "knowledge base" from a data file read when AN-83 is started. Using inductive and deductive logical analysis, this amazing program deduces everything from that data and adds it to its memory. Conversing with you, AN-83 adds and combines with facts already known. It generates new conclusions not explicitly contained in its original knowledge base—just like your own thinking process! The result: it knows considerably more than the specific facts given to it.

AN-83 can also think about anything. It is virtually unlimited in its application. Think of your possibilities. The potential is limitless. In the right hands, AN-83 would revolutionize the adventure, strategy and other smart game-playing programs to say nothing of classic arcade games. On the other hand, AN-83 could be one of the most powerful business analysts available to the home computer.

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In addition, you will be receiving *free*, Eliza—the most amazing conversational A.I. program to date. Run this for your friends and jaws will drop with amazement. Eliza's responses are so human, it's uncanny. An entertaining program, Eliza will answer once and for all the question: What can *your* computer do?

How to Learn Artificial Intelligence

You can be creative. Experiment and modify to fit your personal use because AN-83 and Eliza both possess source code in basic, the most popular easy to use language

for the micro. Their extensive, easy to understand commands walk you through the source code. step by step. It's surprisingly simple. Even the beginner can understand the "How and Why of A.I."

A Fantastic Savings

The real profit to Ennon Corporation will be your participation in the future of Artificial Intelligence. Therefore, I am pleased to say nobody will miss this chance because they could not afford it. AN-83 is priced to cover just a fraction of its research and developmental costs.

The "Thinking" Program AN-83 is just \$23.57. What's more, the astounding Eliza is yours, absolutely free.

I guess it's obvious that I want you to participate in the future of Artificial Intelligence. Forgive my excitement and enthusiasm but I just know you are going to be very happy and impressed that such things could be done with your computer. You just won't believe it. Please take this opportunity now. Simply fill out your coupon below and mail today. Don't miss out. It's such a wonderful future of discovery and excitement that awaits you.

With the very best of wishes,

Richard Olsen

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estimated price, deposit, and COD. If, for example, an item is purchased for \$500.00 and a deposit of \$100.00 is made, the larger amount is entered as Estimate. COD entries occur only when the balance is received. In this way, *TISAR* allows you to see at a glance the amount of money received for a particular period (month or year) as well as money owed you for that same period.

It does this through one of the many search features—records can be searched on any field and printed or displayed. Additionally, there is a cross-search feature which allows sorts on multiple fields. As an example, if you wanted to know how many people named Smith had bought widgets during the month of March, you could.

In screen displays, *TISAR* will present the records in a scrolling form with outstanding amounts highlighted in red, or as a bar chart in which the amounts received will help you to get a handle on the month-to-month ups and downs of your business.

Unfortunately for its stated use as a point-of-sale invoicing system, a database record must be created before an invoice can be filled out. While this would be fine if all customers were repeat customers—and thus a database record on each already existed—I feel that here the long process would slow things to the point that you'd be losing customers. As an alternative, there might be some value in using *TISAR* as a "back-room entry" system, where the true accounting is done after the sale and the invoice would be mailed to the customer simply as a confirmation of the transaction.

In beginning an invoice, you would first probably choose to customize it by having the printed copy show your business name, address, and phone number. As is the case with each of its many routines, *TISAR* will prompt you for each separate entry, and many times will do this by creating a flashing window on the screen.

Following this is a section for printing your company's guarantee or any other message you may need to impart: "No refunds after ten days," "Repairs left over thirty days," etc.

The invoice form itself will depend upon whether your business is sales and marketing or sales and service. As it does with the databases, *TISAR* 128

provides a different invoice for each type of business. When dealing with invoices—as opposed to database records—it is necessary to have several formatted disks on hand. Each disk will hold 125 invoice records, and this in spite of the fact that they are double-sided disks formatted in the 1571 drive.

At the point of sale, enter the customer name; quantity, part number; description of goods or services; price per unit; sales tax rate (or tax exempt); and the amount of deposit or payment. All this is in answer to screen prompts, and fields that do not apply can be avoided by entering "0". Once all entries have been made, the invoice, complete with subtotal, total, deposit, and balance will be printed to the screen and can be sent to your printer, where the heading and guarantee messages will also be printed.

The third part of the system is called *TISAR ICM*—Inventory Control Module. With this, you can store records of up to 1000 individual items on a disk, and there are fields for adding to stock as new merchandise is received or deleted from stock as items are sold.

To accomplish the latter, ICM will process the invoice data disks, reading the items sold and subtracting them from inventory, allowing you a much better feel for the pulse of your business—allowing you to know what items are selling, when they are selling, and the rate of movement. In addition, each item can be keyed to a reorder point: when only 50 widgets are left in inventory, it is time to order more.

With selective display and printing options, the ICM module will allow you a look at all inventory items or only those that have reached the reorder point.

There is no doubt that *TISAR* 128 can be of value to small businesses in helping them to gain better control of the record-keeping and inventory processes, but it does have shortcomings.

First, with the number of disks and programs involved, it should have been written for use on a hard disk or, at the very least, to support two disk drives. Second, it is a bit too cumbersome to be used as a point-of-sale system, though this could have been alleviated by turning the program around. If the database were created from the invoice, it would be a much faster sys-

Continued on page 81

COMMODORES

PROGRAMMING CHALLENGES

By Dale Rupert

Each month, we'll present several challenges designed to stimulate your synapses and toggle the bits in your cerebral random access memory. We invite you to send your solutions to:

Commodores, c/o Ahoy!
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We will print and discuss the cleverest, simplest, shortest, most interesting and/or most unusual solutions. Be sure to identify the *name* and *number* of the problems you are solving. Put *your* name and address on the listings as well. Show sample runs if possible. Briefly describe your solutions and tell what makes them unique or interesting, if they are. You must enclose a stamped, self-addressed envelope if you want any of your materials returned. Solutions received by the middle of the month shown on the magazine cover are most likely to be discussed, but you may send solutions and comments any time. Your original programming problems, suggestions, and ideas are equally welcome. The best ones will become *Commodores*!

PROBLEM #55-1: SIG DIGS

This problem was submitted by Jim Speers (Niles, MI). Write the shortest program which accepts any integer from 0 to 32767 and prints out the number of 1's in its binary representation. The title of this problem comes from the more advanced challenge which is to accept any whole number from 0 to 65535 and print out the number of 1's, significant 0's (ignore leading 0's), and total number of SIGnificant DIGits in its binary representation. (Jim thinks that this second challenge cannot be done in one line.)

For example, if the user enters 65, the computer responds "2" for the first challenge, since the binary value of 65 is 0100 0001 which contains two 1's. For the second challenge, the computer responds "2, 5, 7" since there are two 1's, five non-leading 0's, and seven significant digits.

PROBLEM #55-2: RAPID RANDOMIZER

Try this one from Justin Smalley (Boulder, CO). Start with the following array definition:

```
10 N=100 : DIM X(N) : FOR I=1 TO N: X(I)=I: NEXT
```

Write the rest of the program which will rearrange this array in random order as quickly as possible. Add line 20 to start the timer and line 40 to stop the timer and print the time required to shuffle the array.

```
20 T0 = TI
```

40 PRINT TI-T0 "JIFFIES"

Start your solution at line 30.

PROBLEM #55-3: UNJUMBLED WORDS

Eddie Byrd (Ste. Genevieve, MO) wants to see every possible combination (or permutation) of the letters of any five- or six-letter word entered by the user. He wants his computer to help solve those scrambled-word puzzles in the newspaper. Can you help? (Readers with a good collection of *Ahoy!* back issues may not have much trouble with this one.)

PROBLEM #55-4: POLAR GRAPHICS

This one from Thomson Fung (San Diego, CA) should not be too difficult if you have a C-128 or use *Simon's BASIC* on the C-64. Very simply, write a program to plot a graph of the equation

$R = 10 * T * \cos(T) * \sin(T)$

in polar coordinates. Here R stands for the distance of each point from the origin. T represents the angle of a line from the origin to the given point. If you let T go from 0 to 25.2 in steps of 0.1, you will be rewarded with an interesting butterfly.

First of all I must confess to a blunder regarding the discussion of *Problem #48-4: More Income* in the April issue of *Ahoy!* The problem was the math classic where you are given the option of receiving \$15000 per year under one of two plans. Plan A gives a raise of \$750 every six months. Plan B gives a raise of \$3000 every year. The challenge was to write a program to display the annual and cumulative pay for the two plans. I chastised the readers for their confusion on this problem, since it seemed that most people misinterpreted it.

Fred Simon (Lindenwold, NJ) sent me a letter stating that my readers were not the only ones confused. Although I disagree with Fred's interpretation of the problem, it caused me to rethink the whole situation. Here (I think) is the proper answer to the problem. Plan A is better if you work for just one year; otherwise Plan B is better. (I originally said that Plan A was significantly better overall, contrary to common sense.)

Analyze it this way. Every six months, Plan A increases your base annual salary (BAS) by \$750. Your pay for any six month period is the current BAS divided by two. For example, your BAS for the first six months is clear-

ly \$15000, and your six months' salary is \$15000/2 or \$7500. Everyone agrees on that.

At the end of six months, your BAS goes up to \$15750, so your pay for the second six months is \$15750/2 or \$7875. Your total first-year earnings are \$15375 (\$7500 + \$7875). After one year, your BAS is raised another \$750 to \$16500. You earn \$16500/2 (\$8250) for the first six months of the second year. Then your BAS is raised to \$17250, and you get \$17250/2 (\$8625) for the fourth six-month period. Your total over two years is \$32250.

With Plan B, your BAS is \$15000 for the first year, and that is what you receive. Your BAS is raised to \$18000 which is your second year's salary. At the end of two years, you have accumulated \$33000. Plan B income is ahead of Plan A income by the middle of the second year.

Here is Fred's program adapted slightly to agree with this analysis.

```
•1 REM =====
•2 REM      COMMODARES PROBLEM #48-1 :
•3 REM      MORE INCOME
•4 REM =====
•10 PRINT"YEAR SALARY A TOTAL[3" "]SALARY
      B TOTAL"
•20 BAS=15000: SA=BAS: SB=BAS: TA=0: TB=0
•30 RA=750: RB=3000
•40 FOR YEAR=1 TO 10
•50 TA=TA+SA/2+(SA+RA)/2
•60 TB=TB+SB
•70 PRINT YEAR;TAB(5);$$SA;$$";TA;
•80 PRINT TAB(22);$$"SB;$$"TB
•90 SA=SA+2*RA: SB=SB+RB: NEXT
```

SA and SB are the BAS for Plan A and Plan B. TA and TB are the cumulative totals.

An interesting aspect of this problem is that Plan A is a better plan if it offers semiannual raises of \$1500 as opposed to Plan B's annual \$3000 raise. RA in the program is the amount of Plan A's raise. In fact, if you work for less than eight years, you would be better off with Plan A if it offered increases of only \$1400 semi-annually. (Can anyone figure out the break even point, that is, the amount of Plan A's increase which is equivalent to Plan B?) Experiment with the values and see what you come up with. Thanks to Fred for helping to straighten this out. My apologies to anyone else whose solution was correct the first time around.

Now on to new business. We will look at the best solutions to *Commidores* in the February issue of *Ahoy! Problem #50-1: Phone Decode* was submitted by Pat McConville (Manassas Park, VA). The user inputs a sequence of two-digit numbers representing letters encoded according to the telephone keypad. The computer decodes the numbers into letters. The first digit is the keypad number. The second digit is the letter's position on that key. Since "D" is the first letter on the number 3 key, its code value is 31. "Q" and "Z" are not on the phone keypad, so they are assigned 77 and 99 respectively.

Here is an interesting solution from Eddie Byrd (Ste. Genevieve, MO).

```
•1 REM =====
•2 REM      COMMODARES PROBLEM #50-1 :
•3 REM      PHONE DECODE
•4 REM      SOLUTION BY
•5 REM      EDDIE BYRD
•6 REM =====
•10 A$="20" "ABC[7" "]DEF[7" "]GHI[7" "
      JKL"
•20 A$=A$+"7" "]MNO[7" "]PRS[3" "]Q[3" "
      ]TUV[7" "]WXY[5" "]Z"
•30 INPUT A(1),A(2),A(3)
•40 FOR X=1 TO 3
•50 PRINT MID$(A$,A(X),1);
•60 NEXT:PRINT:GOTO 30
```

Be careful typing the spaces in the definition of A\$ since each character's position in A\$ matches its encoded value. "D" is the 31st character in A\$, and "Z" is the 99th character. The MID\$ statement selects the chosen characters, one at a time. Eddie's method handles invalid numbers greater than zero by returning the space character. To avoid an Illegal Quantity error if the user just presses RETURN without entering a number, add this line:

```
45 IF A(X)=0 THEN 60
```

Don Wilkins (Burke, VA) transformed the numerical input into letters with the following formulas:

$$\begin{aligned} L &= 3 * \text{INT}((N-20)/10) \\ R &= N-10 * \text{INT}(N/10) \\ C &= L+R-((L+R)>16)+6*(R=7)+5*(R=9) \end{aligned}$$

N is the input number ($20 < N < 100$). The corresponding letter is printed with the statement

```
PRINT CHR$(64 + C)
```

Don's program first checked for valid inputs. The last two addends in the formula for C correct for the letters "Q" and "Z". Recall that if $(R=7)$ is true, its value is -1 . Consequently $6*(R=7)$ subtracts six whenever R is seven. The middle term in the formula for C corrects all letters above "Q".

Ernest Barkman (Athens, NY) suggested *Problem #50-2: Short Sound*. The idea is to write the shortest program which will generate a continuous sound. Ernest's solution for the C-64 or the C-128 is shown in line 21 of the following program:

```
•1 REM =====
•2 REM      COMMODARES PROBLEM #50-2 :
•3 REM      SHORT SOUND
•4 REM      SOLUTIONS BY
•5 REM      ERNEST BARKMAN      (LINE 21)
```

```

•6 REM ERNEST BARKMAN SR. (22 & 23)*
•7 REM BOB RENAUD (24)*
•8 REM KEVIN ESHBACH (25)
•9 REM WALLACE LEEKER (26)*
•10 REM ===== (* = C-128 ONLY) =====
=
•21 POKE 54296,RND(1)*9:RUN
•22 PRINT CHR$(7): GOTO 22
•23 A=RND(1)*7+65:PLAY CHR$(A):GOTO 23
•24 PRINT"[CNTRL G]":RUN 24
•25 FORI=54272TO54296:POKEI,RND(1)*255:NE
XT:RUN 25
•26 SOUND 1,999,1:RUN 26

```

Calling the output of this program a "sound" is about the most we can do. "Raspiness" might be a more appropriate term. Still, the program takes only 18 keystrokes (using abbreviations, ignoring spaces, and disregarding the line number and the RETURN at the end of the line), and Ernest's challenge was for brevity. Note that this program takes one more keystroke on the C-128 than on the C-64. Why? "P" SHIFT-O" is POKE on the C-64, but it is POT on the C-128. Use "PO SHIFT-K" on the C-128.

This program randomly sets the volume of the sound generator. Why that should make a sound is not clear. Evidently this challenge generated some family rivalry. The solutions in lines 22 and 23 are from Ernest Barkman Sr. (Orlando, FL), either Ernest's father or else quite a coincidence.

Line 24 by Bob Renaud (Washington, MA) is an even shorter version of line 22. The CONTROL-G which beeps on the C-128 is entered in quote mode. Ignoring line numbers at the beginning and the end of the line, this program takes eight keystrokes using "?" for PRINT. This is undoubtedly the shortest program possible for solving the problem.

Not as short but producing more interesting sounds is line 25 from Kevin Eshbach (Sanatoga, PA). It POKEs random numbers into various SID registers. It runs on the C-64 or the C-128. Wallace Leeker (Lemay, MO) sent the program in line 26. The sound is a pure tone with a slight discontinuity each time the program is rerun. Jim Speers sent a similar solution.

To run any of these, just type RUN followed by the appropriate line number. RUN 25 executes Kevin's program, for example.

Now for *Problem #50-3: Tricky Index* from Justin Smalley (Boulder, CO). The problem is to write line 30 to replace line 29 in the following program so that line 40 prints the index vertically in columns rather than in rows as line 29 does. The result is to have the same number of rows and columns as produced by line 29. Justin mentioned that such a routine can be handy for printing out an alphabetized array.

Jim Borden (Carlisle, PA) sent the following solution which takes advantage of the predefined variables. This allows his program to be easily modified for any number of columns NC and any value of L.

```

•1 REM =====
•2 REM COMMODORES PROBLEM #50-3 :
•3 REM TRICKY INDEX
•4 REM SOLUTION BY
•5 REM JIM BORDEN
•6 REM =====
•10 L=17: NC=5: NR=INT(L/NC)
•20 FOR R=0 TO NR: K=R*NC: FOR C=1 TO NC
•29 REM I=K+C: IF I>L THEN END :REM GIVEN
•30 E=1-(NC*NR-L):D=C-E:I=R+1+(C-1)*(NR+1
):IF D>-1 THEN I=I-D:IF R=NR AND C=E THE
N END
•40 PRINT I;: NEXT: PRINT: NEXT

```

Jim mentioned that E in line 30 should have been defined in line 10, but the *Commodore* allowed changes only to line 30. Do you see the disadvantage of defining E in line 30? In this program, E will be defined 18 times, even though its value never changes. You should not define a variable inside a FOR-NEXT loop unless its value changes within the loop.

Jim Speers suggested modifying line 40 so the results are printed in uniformly spaced columns. He used this statement on the C-128:

```
40 PRINT USING"###";I;: NEXT:PRINT:NEXT
```

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Bob Renaud converted the values to be printed into strings "padded" with spaces to give uniform columns.

Many readers had fun solving *Problem #50-4: Simple Simon*. The challenge was to write the simplest program possible to create the Simon number-sequence memory game. The computer briefly displays three numbers. The user must remember them and enter them in order. The computer then adds another number to the sequence and displays the four-number sequence briefly. The user must enter them in correct order. This process continues until the user fails to enter the list correctly.

This brief program from Judy Groth (Brooklyn, NY) solves the problem in only three lines.

```
•1 REM =====
•2 REM      COMMODORES PROBLEM #50-4
•3 REM      SIMPLE SIMON
•4 REM      SOLUTION BY
•5 REM      JUDY GROTH
•6 REM =====
•10 DEFFNR(S)=INT((RND(S)*9)+1):FORX=1TO3
: A$=A$+MID$(STR$(FNR(1)),2,1):NEXT:PRINT
A$
•20 FORD=1TOX*300:NEXT:PRINT"[CLEAR]":IN
PUTB$:IFB$<>A$THENPRINT"SCORE="((X-4)*10
):END
•30 X=X+1:A$=A$+MID$(STR$(FNR(1)),2,1):PR
INT" "A$::GOTO20
```

Notice Judy's user-defined function in line 10. This function generates random integers from 1 to 9. This program keeps score, awarding 10 points for each digit in the last number entered correctly.

As if three lines were not short enough, Sharon Albers (Walters, MN) sent this nifty two-liner.

```
•1 REM =====
•2 REM      COMMODORES PROBLEM #50-4
•3 REM      SIMPLE SIMON
•4 REM      SOLUTION BY
•5 REM      SHARON ALBERS
•6 REM =====
•10 X$=X$+RIGHT$(STR$(INT(RND(0)*10)),1):ON-(LEN(X$)<3)GOTO4:PRINT"[CLEAR][DOWN][
```

PROGRAMS WANTED!

We're always in search of the best game, utility, and productivity programs available for the C-64, C-128, and Amiga. If you've written a program which fits that description, send it on disk, accompanied by printed documentation, a program printout, and a stamped, self-addressed envelope to:

Ahoy! Program Submissions Dept.
Ion International Inc.
45 West 34th Street—Suite 500
New York, NY 10001

```
DOWN][RIGHT][RIGHT]"X$  
•11 FORT=1TO500:NEXT:INPUT"[CLEAR][DOWN][
DOWN]";I$:ON-(X$=I$)GOTO4:PRINT"INCORREC
T -- "X$::END
```

X\$ holds the computer's number sequence. The first statement in line 10 picks a random digit, converts it into a string, and strips away the leading space. Another interesting aspect of Sharon's program is her use of the ON-GOTO statements. These allow the equivalent of IF-THEN conditional statements to be executed while having other commands follow on the same line. This is a handy procedure for the C-64 which does not allow the ELSE statement. A nice feature of this program is the final PRINT statement which shows the actual number which the user missed.

Some readers were careful to empty the keyboard buffer before accepting user input. This is to prevent cheaters from typing the numbers while they are displayed on the screen. (Of course, the real criminals would use pencil and paper.)

POKE 208,0 clears the keyboard buffer on the C-128. Use POKE 198,0 for the C-64.

The ultimate in brevity is this one-liner for the C-128 from Charles Kluepfel (Bloomfield, NJ).

```
•1 REM =====
•2 REM      COMMODORES PROBLEM #50-4
•3 REM      SIMPLE SIMON
•4 REM      SOLUTION BY
•5 REM      CHARLES KLUEPFEL
•6 REM =====
•10 A=RND(-TI):DO:A$="":DO:DO:A$=A$+CHR$(48+10*RND(1)):LOOP UNTIL LEN(A$)>2:PRINT
"[CLEAR]"A$::SLEEP1:INPUT"[CLEAR]";B$:LOO
P WHILEA$=B$:PRINT"NO, IT IS":PRINTA$:GET
KEYA$::LOOP
```

Charles said that this illustrates the power of BASIC 7.0. Indeed it does. You may better understand the logic of the program if you rewrite it, indented with one statement per line.

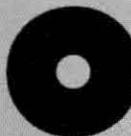
Hopefully you will enjoy improving your memory with these simple Simon solutions. Have fun working on this month's problems. Keep those solutions and suggestions coming. □

Congratulations to the following readers who have not been mentioned already this month:

Necah Buyukdura (Ankara, Turkey)	Craig Morse (Minot, ND)
Harlan Clussman (Wausau, WI)	Jerry Nichols
Oren Dalton (El Paso, TX)	Federico Oste (Loreto, Italy)
Tameem Hallak	Myong Paek (Portland, OR)
Terry Jernigan (Raleigh, NC)	Donald Pellegrini
Larry Louks (Freeport, TX)	(Arroyo Grande, CA)
Ron McManus (Lenore, ID)	Robert Rispoli (Ridge, NY)
Steve Morrison (Port Hueneme, CA)	Mark Roschke
	Andrew Rosenthal
	(Flushing, NY)

PROGRAM LISTINGS

Attention new Ahoy! readers! You must read the following information very carefully prior to typing in programs listed in Ahoy! Certain Commodore characters, commands, and strings of characters and commands will appear in a special format. Follow the instructions and listings guide on this page.



In the following pages you'll find several programs that you can enter on your Commodore computer. But before doing so, read this entire page carefully.

To insure clear reproductions, *Ahoy!*'s program listings are generated on a daisy wheel printer, incapable of printing the commands and graphic characters used in Commodore programs. These are therefore represented by various codes enclosed in brackets []. For example: the SHIFT CLR/HOME command is represented onscreen by a heart



. The code we use in our listings is [CLEAR]. The chart below lists all such codes which you'll encounter in our listings, except for one other special case.

The other special case is the COMMODORE and SHIFT characters. On the front of most keys are two symbols. The symbol on the left is obtained by pressing that key while holding down the COMMODORE key; the symbol on the right, by pressing that key while holding down the SHIFT key. COMMODORE and SHIFT characters are represented in our listings by a lower-case "s" or "c" followed by the symbol of the key you must hit. COMMODORE J, for example, is represented by [c J], and SHIFT J by [s J].

Additionally, any character that occurs more than two times in a row will be displayed by a coded listing. For example, [3 "[LEFT]"] would be 3 CuRSOr left commands in a row, [5 "[s EP]"] would be 5 SHIFTed English Pounds, and so on. Multiple blank spaces will be noted in similar fashion: e.g., 22 spaces as [22 " "].

Sometimes you'll find a program line that's too long for the computer to accept (C-64 lines are a maximum of 80 characters, or 2 screen lines long; C-128 lines, a maximum of 160 characters, 2 or 4 screen lines in 40 or 80 columns respectively). To enter these lines, refer to the *BASIC Command Abbreviations Appendix* in your User Manual.

On the next page you'll find our *Bug Repellent* programs for the C-128 and C-64. The version for your machine will help you proofread programs after typing them. (Please note: the *Bug Repellent* line codes that follow each program line, in the whited-out area, should *not* be typed in. See instructions preceding each program.)

On the second page following you will find *Flankspeed*, our ML entry program, and instructions on its use.

Call *Ahoy!* at 212-239-6089 with any problems (if busy or no answer after three rings, call 212-239-0855).

WHEN YOU SEE	IT MEANS	YOU TYPE	YOU WILL SEE	WHEN YOU SEE	IT MEANS	YOU TYPE	YOU WILL SEE	
[CLEAR]	Screen Clear	SHIFT	CLR/HOME	♥	[BLACK]	Black	CNTRL 1	█
[HOME]	Home		CLR/HOME	█	[WHITE]	White	CNTRL 2	█
[UP]	Cursor Up	SHIFT	↑ CCSR ↓	█	[RED]	Red	CNTRL 3	█
[DOWN]	Cursor Down		↑ CCSR ↓	█	[CYAN]	Cyan	CNTRL 4	█
[LEFT]	Cursor Left	SHIFT	← CCSR →	█	[PURPLE]	Purple	CNTRL 5	█
[RIGHT]	Cursor Right		← CCSR →	█	[GREEN]	Green	CNTRL 6	█
[SS]	Shifted Space	SHIFT	Space	█	[BLUE]	Blue	CNTRL 7	█
[INSERT]	Insert	SHIFT	INST/DEL	█	[YELLOW]	Yellow	CNTRL 8	█
[DEL]	Delete		INST/DEL	█	[F1]	Function 1	F1	█
[RVSON]	Reverse On	CNTRL	9	█	[F2]	Function 2	SHIFT F1	█
[RVSOFF]	Reverse Off	CNTRL	0	█	[F3]	Function 3	F3	█
[UPARROW]	Up Arrow		↑	█	[F4]	Function 4	SHIFT F3	█
[BACKARROW]	Back Arrow		←	█	[F5]	Function 5	F5	█
[PI]	PI		π	π	[F6]	Function 6	SHIFT F5	█
[EP]	English Pound		£	£	[F7]	Function 7	F7	█
					[F8]	Function 8	SHIFT F7	█

BUG REPELLENT FOR THE 64 & 128 By BUCK CHILDRESS

Please note: the *Bug Repellent* programs listed here are for *Ahoy!* programs published from the May 1987 issue onward! For older programs, use the older version.

Type in, save, and run *Bug Repellent*. You'll be asked if you want automatic saves to take place. If so, you're prompted for the device, DISK (D) or TAPE (T). You then pick a starting file number, 0 through 99. Next, you enter a name, up to 14 characters long. At this point, *Bug Repellent* verifies your entries and gives you a chance to change them if you want. If no changes are needed, *Bug Repellent* activates itself. (Pressing RETURN without answering the prompts defaults to disk drive and begins your files with "00BACKUP".)

Type NEW and begin entering an *Ahoy!* program. As you enter program lines and press RETURN, a *Bug Repellent* code appears at the top of your screen. If it doesn't match the code in the program listing, an error exists. Correct the line and the codes will match.

If used, automatic saves take place every 15 minutes. When the RETURN key is pressed on a program line, the screen changes color to let you know that a save will begin in about three seconds. You may cancel the save by pressing the RUN STOP key. The file number increments after each save. It resets to 00 if 99 is surpassed. After saving, or cancelling, the screen returns to its original color and the timer resets for 15 minutes.

When you've finished using *Bug Repellent*, deactivate it by typing SYS 49152 [RETURN] for the Commodore 64 or SYS 4864 [RETURN] for the Commodore 128.

C-64 BUG REPELLENT

```
•10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=49152
•20 FORB=0:TO11:READA:IFA<0ORA>255THEN40
•30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
•40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(64)*256+PEEK(65)
:END
•50 X=0:J=J+12:IFJ<49456THEN20
•60 POKE198,0:POKE49456,0:A$="Y":B$=A$:C$="D":D$="DISK":D
=8:PRINTCHR$(147)
•70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)":A$:PRINT:IFA
$="Y"THEN90
•80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
•90 POKE49456,1:INPUT"DISK OR TAPE (D/T)":C$:IFC$<>"D"THEN
ND=1:D$="TAPE"
•100 POKE49457,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (0-99)":N
•110 N$=RIGHT$(STR$(N),2):IFN<10THENNN$=CHR$(48)+CHR$(N+48)
)
•120 F$="BACKUP":PRINT:INPUT"FILENAME":F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
•130 POKE49458,L:FORJ=1TO1:POKE49458+J,ASC(MID$(F$,J,1)):NEXTJ:PRINT
•140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
•150 PRINT:INPUT"IS THIS CORRECT (Y/N)":B$:IFB$<>"Y"THEN6
•160 POKE770,131:POKE771,164:SYS49152:END
•170 DATA169,79,32,210,255,162,38,160,192,204,3,3,1507
•180 DATA208,10,162,131,160,164,169,70,32,210,255,44,1615
•190 DATA169,78,32,210,255,142,2,3,140,3,3,76,1113
•200 DATA36,193,32,96,165,134,122,132,123,32,115,0,1180
•210 DATA170,240,243,162,255,134,58,144,3,76,150,164,1799
•220 DATA32,167,169,32,121,165,173,0,2,240,5,169,1215
•230 DATA79,141,2,3,76,162,164,169,0,133,2,133,1064
•240 DATA251,133,252,133,254,24,101,20,69,254,230,254,197
5
•250 DATA24,101,21,69,254,170,230,254,164,252,185,0,1724
•260 DATA2,133,253,201,34,208,6,165,2,73,255,133,1465
•270 DATA2,201,32,208,4,165,2,240,8,138,24,101,1125
•280 DATA253,69,254,170,44,198,254,230,252,164,253,208,23
49
•290 DATA213,138,41,240,74,74,74,24,105,129,141,1327
•300 DATA44,193,138,41,15,24,105,129,141,45,193,162,1230
•310 DATA0,189,43,193,240,12,157,0,4,173,134,2,1147
•320 DATA157,0,216,232,208,239,169,38,141,2,3,173,1578
•330 DATA48,193,240,23,165,161,201,212,176,4,165,160,1748
•340 DATA240,13,238,32,208,160,0,32,225,255,208,6,1617
•350 DATA32,33,193,76,38,192,232,208,242,200,208,239,1893
•360 DATA32,68,229,169,0,168,174,49,193,32,186,255,1555
•370 DATA173,50,193,162,51,160,193,32,189,255,169,43,1670
•380 DATA166,45,164,46,32,216,255,162,1,189,51,193,1520
•390 DATA168,200,152,201,58,144,2,169,48,157,51,193,1543
•400 DATA201,48,208,3,202,16,234,32,33,193,76,116,1362
•410 DATA164,206,32,208,169,0,170,168,76,219,255,160,1827
•420 DATA1,1,160,0,0,65,72,79,89,33,0,0,500
```

C-128 BUG REPELLENT

```
•10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=4864
•20 FORB=0:TO11:READA:IFA<0ORA>255THEN40
•30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
•40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(66)*256+PEEK(65)
:END
•50 X=0:J=J+12:IFJ<5213THEN20
•60 POKE208,0:POKE5213,0:A$="Y":B$=A$:C$="D":D$="DISK":D
=8:PRINTCHR$(147)
•70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)":A$:PRINT:IFA
$="Y"THEN90
•80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
•90 POKE5213,1:INPUT"DISK OR TAPE (D/T)":C$:IFC$<>"D"THEN
D=1:D$="TAPE"
•100 POKE5214,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (0
-99)":N
•110 N$=RIGHT$(STR$(N),2):IFN<10THENNN$=CHR$(48)+CHR$(N+48)
)
•120 F$="BACKUP":PRINT:INPUT"FILENAME":F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
•130 POKE5215,L:FORJ=1TO1:POKE5215+J,ASC(MID$(F$,J,1)):NE
XTJ:PRINT
•140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
•150 PRINT:INPUT"IS THIS CORRECT (Y/N)":B$:IFB$<>"Y"THEN6
•160 POKE770,198:POKE771,77:SYS4864:END
•170 DATA32,58,20,169,41,162,19,236,3,3,208,4,955
•180 DATA169,198,162,77,141,2,3,142,3,3,224,19,1143
•190 DATA208,7,32,125,255,79,78,0,96,32,125,255,1292
•200 DATA79,70,70,0,96,162,0,134,251,189,0,2,1053
•210 DATA240,19,201,48,144,9,201,58,176,5,133,251,1485
•220 DATA232,268,238,134,252,165,251,208,3,76,198,77,2042
•230 DATA169,0,166,235,164,236,133,253,133,254,142,47,193
2
•240 DATA20,140,48,20,24,101,22,69,254,230,254,24,1206
•250 DATA101,23,69,254,170,230,254,164,252,185,0,2,1704
•260 DATA133,251,201,34,208,6,165,253,73,255,133,253,1965
•270 DATA201,32,208,4,165,253,240,8,138,24,101,251,1625
•280 DATA69,254,170,44,198,254,230,252,164,251,208,213,23
07
•290 DATA138,41,240,74,74,74,24,105,65,141,88,1138
•300 DATA20,138,41,15,24,105,65,141,89,20,32,79,769
•310 DATA20,189,85,20,240,6,32,210,255,232,208,245,1742
•320 DATA174,47,20,172,48,20,24,32,240,255,173,93,1298
•330 DATA20,240,27,165,161,201,212,176,4,165,160,240,1771
•340 DATA17,32,65,20,238,32,208,238,1,214,32,225,1322
•350 DATA255,208,6,32,49,20,76,198,77,232,208,242,1603
•360 DATA200,208,239,32,66,193,173,95,20,162,96,160,1644
•370 DATA20,32,189,255,169,0,170,32,104,255,169,0,1395
•380 DATA174,94,20,168,32,186,255,169,45,174,16,18,1351
•390 DATA172,17,18,32,216,255,162,1,189,96,20,168,1346
•400 DATA200,152,201,58,144,2,169,48,157,96,20,201,1448
•410 DATA48,208,3,202,16,234,32,49,20,141,0,2,955
•420 DATA76,183,77,58,59,32,65,20,206,32,208,206,1222
•430 DATA1,214,169,0,170,168,76,219,255,32,79,20,1403
•440 DATA169,26,141,0,214,173,0,214,16,251,96,162,1462
•450 DATA0,142,0,255,96,19,18,32,32,32,146,804
•460 DATA0,1,0,0,65,72,79,89,33,0,0,339
```

FLANKSPEED FOR THE C-64 By GORDON F. WHEAT

Flankspeed will allow you to enter machine language *Ahoy!* programs without any mistakes. Once you have typed the program in, save it for future use. While entering an ML program with *Flankspeed* there is no need to enter spaces or hit the carriage return. This is all done automatically. If you make an error in a line a bell will ring and you will be asked to enter it again. To LOAD in a program Saved with *Flankspeed* use LOAD "name",1.1 for tape, or LOAD "name",8.1 for disk. The function keys may be used after the starting and ending addresses have been entered.

f1—SAVEs what you have entered so far.

f3—LOADs in a program worked on previously.

f5—To continue on a line you stopped on after LOADing in the previous saved work.

f7—Scans through the program to locate a particular line, or to find out where you stopped the last time you entered the program. It temporarily freezes the output as well.

•100 POKE53280,12:POKE53281,11	OP	5	IK
•105 PRINT"[CLEAR][c 8][RVSON][15" "]FLANKSPEED[15" "]";	FP	•390 PRINT:PRINT"ADDRESS NOT WITHIN SPECIFIED RANGE!":B=0:	HK
•110 PRINT"[RVSON][5" "]MISTAKEPROOF ML ENTRY PROGRAM[6" "]	JP	GOTO415	DM
•115 PRINT"[RVSON][9" "]CREATED BY G. F. WHEAT[9" "]	FA	•395 PRINT:PRINT"NOT ZERO PAGE OR ROM!":B=0:GOTO415	JK
•120 PRINT"[RVSON][3" "]COPR. 1987, ION INTERNATIONAL INC.	AJ	•400 PRINT"?ERROR IN SAVE":GOTO415	IO
[3" "]	ND	•405 PRINT"?ERROR IN LOAD":GOTO415	JO
•125 FORA=54272T054296:POKEA,0:NEXT	NP	•410 PRINT:PRINT:PRINT"END OF ML AREA":PRINT	BF
•130:POKE54272,4:POKE54273,48:POKE54277,0:POKE54278,249:PO	FL	•415 POKE54276,17:POKE54276,16:RETURN	DH
KES54296,15	FF	•420 OPEN15,8,15:INPUT#15,A,A\$:CLOSE15:PRINTA\$:RETURN	IM
•135 FORA=680T0699:READB:POKEA,B:NEXT	EK	•425 REM GET FOUR DIGIT HEX	OL
•140 DATA169,251,166,253,164,254,32,216,255,96	KP	•430 PRINT:PRINTBS\$:INPUTTS\$	JD
•145 DATA169,0,166,251,164,252,32,213,255,96	OE	•435 IFLEN(T\$)<>4THENGOSUB380:GOTO430	AK
•150 B\$="STARTING ADDRESS IN HEX":GOSUB430:AD=B:SR=B	AM	•440 FORA=1T04:A\$=MIDS\$(T\$,A,1):GOSUB450:IFT(A)=16THENGOSUB	KB
•155 GOSUB480:IFB=0THEN150	PE	380:GOTO430	GM
•160 POKE251,T(4)+T(3)*16:POKE252,T(2)+T(1)*16	PG	•445 NEXT:B=(T(1)*4096)+(T(2)*256)+(T(3)*16)+T(4):RETURN	NJ
•165 B\$="ENDING ADDRESS IN HEX":GOSUB430:EN=B	GM	•450 IFA\$>"@ANDA\$<"G"THEN(A)=ASC(A\$)-55:RETURN	IC
•170 GOSUB470:IFB=0THEN150	HG	•455 IFA\$>"/"ANDA\$<":THENT(A)=ASC(A\$)-48:RETURN	OL
•175 POKE254,T(2)+T(1)*16:B=T(4)+1+T(3)*16	HG	•460 T(A)=16:RETURN	HO
•180 IFB=255THENB=B-255:POKE254,PEEK(254)+1	EC	•465 REM ADDRESS CHECK	LE
•185 POKE253,B:PRINT	ED	•470 IFAD>ENTHEN385	OB
•190 REM GET HEX LINE	KD	•475 IFB<SRORB>ENTHEN390	HE
•195 GOSUB495:PRINT": [c P][LEFT]";:FORA=0T08	IH	•480 IFB<256OR(B>4096)ANDB<49152)ORB>53247THEN395	PM
•200 FORB=0TO1:GOTO250	IJ	•485 RETURN	AP
•205 NEXTB	IJ	•490 REM ADDRESS TO HEX	NF
•210 A%(A)=T(1)+T(0)*16:IFAD+A-1=ENTHEN340	FA	•495 AC=AD:A=4096:GOSUB520	LG
•215 PRINT" [c P][LEFT]";	EG	•500 A=256:GOSUB520	HE
•220 NEXTA:T=AD-(INT(AD/256)*256):PRINT" "	II	•505 A=16:GOSUB520	JD
•225 FORA=0T07:T=T+A%(A):IFT>255THEN=T-255	GL	•510 A=1:GOSUB520	GI
•230 NEXT	GI	•515 RETURN	OC
•235 IFAZ(8)<>TTHENGSUB375:GOTO195	FL	•520 T=INT(AC/A):IFT>9THENA\$=CHR\$(T+55):GOTO530	JI
•240 FORA=0T07:POKEAD+A,A%(A):NEXT:AD=AD+B:GOTO195	IM	•525 A\$=CHR\$(T+48)	AA
•245 REM GET HEX INPUT	PA	•530 PRINTA\$::AC=AC-A*T:RETURN	IC
•250 GETA\$:IFA\$=""THEN250	GA	•535 A\$="**SAVE**":GOSUB585	AB
•255 IFA\$=CHR\$(20)THEN305	GO	•540 OPEN1,T,1,A\$:SYS680:CLOSE1	FB
•260 IFA\$=CHR\$(133)THEN535	LM	•545 IFST=0THENEND	PM
•265 IFA\$=CHR\$(134)THEN560	IG	•550 GOSUB400:IFT=8THENGOSUB420	FI
•270 IFA\$=CHR\$(135)THENPRINT" ":GOTO620	HO	•555 GOTO535	PE
•275 IFA\$=CHR\$(136)THENPRINT" ":GOTO635	HE	•560 A\$="**LOAD**":GOSUB585	PO
•280 IFA\$>"@ANDA\$<"G"THEN(B)=ASC(A\$)-55:GOTO295	MI	•565 OPEN1,T,0,A\$:SYS690:CLOSE1	OI
•285 IFA\$>"/"ANDA\$<":THENT(B)=ASC(A\$)-48:GOTO295	DJ	•570 IFST=64THEN195	CO
•290 GOSUB415:GOTO250	JA	•575 GOSUB405:IFT=8THENGOSUB420	GN
•295 PRINTA" [c P][LEFT]";	PK	•580 GOTO560	KA
•300 GOTO205	FA	•585 PRINT" :PRINTTAB(14)A\$	IO
•305 IFA>0THEN320	BI	•590 PRINT:A\$=""::INPUT"FILENAME":A\$	HK
•310 A=-1:IFB=1THEN330	BB	•595 IFA\$=""THEN590	HL
•315 GOT0220	FA	•600 PRINT:PRINT"TAPE OR DISK?":PRINT	NP
•320 IFB=0THENPRINTCHR\$(20);CHR\$(20)::A=A-1	BF	•605 GETB\$::T=1:IFB\$="D"THEN=8:A\$="@":+A\$:RETURN	KO
•325 A=A-1	FK	•610 IFB\$<>"T"THEN605	PH
•330 PRINTCHR\$(20)::GOTO220	PH	•615 RETURN	DD
•335 REM LAST LINE	CP	•620 B\$="CONTINUE FROM ADDRESS":GOSUB430:AD=B	NK
•340 PRINT" :T=AD-(INT(AD/256)*256)	KH	•625 GOSUB475:IFB=0THEN620	HN
•345 FORB=0TOA-1:T=T+A%(B):IFT>255THEN=T-255	OD	•630 PRINT:GOTO195	FK
•350 NEXT	OB	•635 BS="BEGIN SCAN AT ADDRESS":GOSUB430:AD=B	LN
•355 IFAZ(A)<>TTHENGSUB375:GOTO195	LH	•640 GOSUB475:IFB=0THEN635	HI
•360 FORB=0TOA-1:POKEAD+B,A%(B):NEXT	BO	•645 PRINT:GOTO670	LM
•365 PRINT:PRINT"YOU ARE FINISHED!":GOTO535	MB	•650 FORB=0T07:AC=PEEK(AD+B):GOSUB505:IFAD+B=ENTHENAD=SR:G	CD
•370 REM BELL AND ERROR MESSAGES	LM	0SUB410:GOTO195	JD
•375 PRINT:PRINT"LINE ENTERED INCORRECTLY":PRINT:GOT0415	JK	•655 PRINT" :NEXTB	KE
•380 PRINT:PRINT"INPUT A 4 DIGIT HEX VALUE!":GOT0415	PG	•660 PRINT:AD=AD+8	
•385 PRINT:PRINT"ENDING IS LESS THAN STARTING!":B=0:GOT041		•665 GETB\$::IFB\$=CHR\$(136)THEN195	
		•670 GOSUB495:PRINT": ::GOT0650	

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VARI-SCAN

FROM PAGE 30

C-64 VERSION

```

•10 REM *** VARI-SCAN 64 *** BUCK CHILDRE
SS ***
•20 REM *** P.O. BOX 13575 SALEM, OR 9730
9 ***
•30 PRINTCHR$(147)"LOADING AND CHECKING D
ATA LINE:";J=52000
•40 FORB=5TO11:READA
•50 IFB=0THENL=PEEK(64)*256+PEEK(63):PRIN
TCHR$(19)TAB(31)L:PRINT
•60 IFA<0ORA>255THEN80
•70 POKEJ+B,A:X=X+A:D=D+1:NEXTB:READA:IFA
=XTHEN90
•80 PRINT"ERROR IN DATA LINE:"L:END
•90 X=0:J=J+12:IFD<564THEN40
•100 PRINT"THE DATA IS OK[3"."]":PRINT
•110 PRINT"SYS 52[3"0"] TO ACTIVATE[3"."]
":END
•120 DATA104,104,169,79,32,210,255,169,78
,162,57,160,1579
•130 DATA203,142,0,3,140,1,3,32,210,255,7
6,179,1244
•140 DATA204,173,0,2,201,95,208,17,169,79
,32,210,1390
•150 DATA255,169,70,32,210,255,162,139,16
0,227,76,45,1800
•160 DATA203,201,65,144,4,201,91,144,3,76
,139,227,1498
•170 DATA32,96,166,162,0,160,0,140,85,205
,140,83,1269
•180 DATA205,189,1,2,240,47,48,198,201,32
,208,3,1374
•190 DATA232,208,242,72,173,85,205,208,10
,192,0,240,1867
•200 DATA6,104,201,48,176,238,72,104,153,
1,2,201,1306
•210 DATA48,176,10,141,85,205,201,40,208,
3,141,83,1341
•220 DATA205,232,200,208,204,153,1,2,165,
43,166,44,1623
•230 DATA133,251,134,252,134,254,160,0,17
7,43,133,253,1924
•240 DATA152,145,45,200,208,251,141,90,20
5,141,92,205,1875
•250 DATA32,2,205,160,2,177,251,200,209,2
51,208,7,1704
•260 DATA201,0,208,3,76,167,204,170,177,2
51,141,88,1686
•270 DATA205,142,89,205,160,3,32,2,205,14
1,91,205,1480
•280 DATA173,92,205,240,8,162,0,142,92,20

```

5,32,187,1538	AL
•290 DATA204,200,177,251,208,3,76,135,204 ,201,131,240,2030	AL
•300 DATA4,201,143,208,3,76,138,204,201,3 4,208,7,1427	IK
•310 DATA174,91,205,240,212,208,207,174,9 1,205,208,208,2223	GE
•320 DATA201,65,144,22,201,91,176,200,141 ,92,205,174,1712	PJ
•330 DATA84,205,208,55,174,87,205,224,2,1 44,51,76,1515	EP
•340 DATA237,203,174,92,205,240,190,201,5 8,176,173,201,2150	BG
•350 DATA48,176,228,201,32,240,178,201,36 ,240,21,201,1802	EP
•360 DATA37,240,17,201,40,240,13,201,41,2 40,9,201,1480	BC
•370 DATA44,208,29,174,83,205,240,24,141, 84,205,174,1611	KC
•380 DATA87,205,157,93,205,238,87,205,201 ,41,208,11,1738	BF
•390 DATA173,83,205,208,3,206,87,205,76,2 24,203,201,1874	CG
•400 DATA40,208,17,232,142,86,205,173,83, 205,208,8,1607	AP
•410 DATA169,0,141,92,205,141,87,205,76,2 37,203,32,1588	BA
•420 DATA187,204,32,5,205,166,253,165,254 ,240,20,134,1865	DN
•430 DATA251,133,252,160,0,177,253,72,200 ,177,253,133,2061	HI
•440 DATA254,104,133,253,76,191,203,173,9 0,205,208,7,1897	KL
•450 DATA169,47,160,205,32,30,171,169,0,1 41,0,2,1126	GP
•460 DATA76,116,164,162,0,189,0,2,240,18 ,201,92,1260	GO
•470 DATA208,6,236,86,205,76,215,204,221, 93,205,208,1963	JJ
•480 DATA49,232,208,233,236,87,205,208,41 ,104,104,173,1880	FI
•490 DATA90,205,208,7,169,21,160,205,32,3 0,171,169,1467	GK
•500 DATA76,160,205,32,30,171,173,88,205, 174,89,205,1608	LG
•510 DATA32,205,189,169,13,32,210,255,141 ,90,205,76,1617	NJ
•520 DATA138,204,169,0,170,157,93,205,232 ,208,250,141,1967	IE
•530 DATA84,205,141,86,205,141,87,205,96, 13,18,86,1367	DK
•540 DATA65,82,73,65,66,76,69,32,73,83,32 ,73,789	IB
•550 DATA78,32,85,83,69,46,46,13,13,0, 13,524	JA

C-128 VERSION

AL	•560 DATA18,86,65,82,73,65,66,76,69,32,73,83,788	MI	•280 DATA253,173,16,18,174,17,18,133,65,134,66,152,1219	GO
AL	•570 DATA32,78,79,84,32,73,78,32,85,83,69,46,771	GN	•290 DATA145,65,200,208,251,141,125,21,141,127,21,32,1477	HB
AL	•580 DATA46,46,13,0,76,73,78,69,58,32,0,20,711	CO	•300 DATA92,21,160,2,177,251,200,209,251,208,7,201,1779	AO
IK			•310 DATA0,208,3,76,194,20,170,177,251,141,123,21,1384	CK
GE	•10 REM *** VARI-SCAN 128 *** BUCK CHILDR ESS ***	ED	•320 DATA142,124,21,160,3,32,92,21,141,126,21,173,1056	HJ
PJ	•20 REM *** P.O. BOX 13575 SALEM, OR 97309 ***	OA	•330 DATA127,21,240,8,162,0,142,127,21,32,247,20,1147	JP
EP	•30 PRINTCHR\$(147)"LOADING AND CHECKING DATA LINE:";J=4864	AD	•340 DATA200,177,251,208,3,76,162,20,201,131,240,4,1673	JC
BG	•40 FORB=0TO11:READA	MB	•350 DATA201,143,208,3,76,165,20,201,34,208,7,174,1440	DJ
EP	•50 IFB=0THENL=PEEK(66)*256+PEEK(65):PRINT TCHR\$(19)TAB(31)L:PRINT	LB	•360 DATA126,21,240,212,208,207,174,126,21,208,208,201,1952	GL
BC	•60 IFA<0ORA>255THEN80	FK	•370 DATA65,144,22,201,91,176,200,141,127,21,174,119,1481	HH
KC	•70 POKEJ+B,A:X=X+A:D=D+1:NEXTB:READA:IFA =XTHEN90	PL	•380 DATA21,208,55,174,122,21,224,2,144,51,76,8,1106	JO
BF	•80 PRINT"ERROR IN DATA LINE:"L:END	MG	•390 DATA20,174,127,21,240,190,201,58,176,173,201,48,1629	HB
CG	•90 X=0:J=J+12:IFD<636THEN40	FB	•400 DATA176,228,201,32,240,178,201,36,240,21,201,37,1791	EI
AP	•100 PRINT"THE DATA IS OK[3"."]":PRINT	AJ	•410 DATA240,17,201,40,240,13,201,41,240,9,201,44,1487	MN
BA	•110 PRINT"SYS 4864 TO ACTIVATE[3"."]":END	ND	•420 DATA208,29,174,118,21,240,24,141,119,21,174,122,1391	FJ
DN	•120 DATA104,104,32,129,146,79,78,0,169,29,162,19,1051	PI	•430 DATA21,157,128,21,238,122,21,201,41,298,11,173,1342	HP
HI	•130 DATA141,2,3,142,3,3,169,69,141,0,3,142,818	AN	•440 DATA118,21,208,3,206,122,21,76,251,19,201,40,1286	CJ
KL	•140 DATA1,3,76,236,20,169,0,162,19,133,251,141,1211	EJ	•450 DATA208,17,232,142,121,21,173,118,21,208,8,169,1438	JM
GP	•150 DATA0,255,134,252,169,251,141,185,2,162,1,160,1712	IN	•460 DATA0,141,127,21,141,122,21,76,8,20,32,247,956	JF
GO	•160 DATA0,177,251,32,119,255,230,251,208,238,230,252,2243	KK	•470 DATA20,32,95,21,166,253,165,254,240,20,134,251,1651	AA
JJ	•170 DATA165,252,201,22,144,230,76,198,77,173,0,2,1540	GP	•480 DATA133,252,160,0,177,253,72,200,177,253,133,254,2064	EG
FI	•180 DATA201,95,208,22,32,129,146,79,70,70,0,169,1221	PL	•490 DATA104,133,253,76,218,19,173,125,21,208,37,169,1536	JF
GK	•190 DATA198,162,77,141,2,3,142,3,3,169,63,76,1039	KD	•500 DATA0,141,0,255,32,129,146,13,18,86,65,82,967	OI
LG	•200 DATA20,19,201,65,144,4,201,91,144,3,76,63,1031	JG	•510 DATA73,65,66,76,69,32,73,83,32,78,79,84,810	FJ
NJ	•210 DATA77,32,250,81,162,0,160,0,140,120,21,140,1183	DE	•520 DATA32,73,78,32,85,83,69,46,46,46,13,0,603	AN
IE	•220 DATA118,21,189,1,2,240,47,48,153,201,32,208,1260	PP	•530 DATA169,0,141,0,2,141,0,255,76,55,77,162,1078	FJ
DK	•230 DATA3,232,208,242,72,173,120,21,208,10,192,0,1481	HN	•540 DATA0,189,0,2,240,18,201,92,208,6,23,6,121,1313	DK
IB	•240 DATA240,6,104,201,48,176,238,72,104,153,1,2,1345	AF	•550 DATA21,76,19,21,221,128,21,208,79,23,2,208,233,1467	HL
JA	•250 DATA201,48,176,10,141,120,21,201,40,208,3,141,1310	IB	•560 DATA236,122,21,208,71,104,104,169,0,141,0,255,1431	FM

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•570 DATA173,125,21,208,29,32,129,146,13,
18,86,65,1045 HO
•580 DATA82,73,65,66,76,69,32,73,83,32,73
,78,802 JJ
•590 DATA32,85,83,69,46,46,46,13,13,0,32,
129,594 KF
•600 DATA146,76,73,78,69,58,32,0,173,123,
21,174,1023 MO
•610 DATA124,21,32,50,142,169,13,32,210,2
55,141,125,1314 KM
•620 DATA21,76,165,20,169,0,170,157,128,2
1,232,208,1367 IN
•630 DATA250,141,119,21,141,121,21,141,12
2,21,169,63,1330 KJ
•640 DATA141,0,255,169,0,96,0,0,65,72,83,
0,881 HC

220 "OC01B 8C 02 DC STY \$DC02
230 "OC01E 58 CLI
240 "OC01F 60 RTS

THERMAL CONNECTION

•1 REM ======
•2 REM
•3 REM THERMAL CONNECTION
•4 REM
•5 REM RUPERT REPORT #55
•6 REM
•7 REM ======
•8 REM CALIBRATE AND READ THERMISTOR
•9 REM CONNECTED TO PADDLE INPUT
•10 REM ======
•20 DEF FNR(X)=INT(10*X+.5)/10 :REM
ROUND OFF TO 1 DECIMAL
•30 DEF FNK2F(T)=1.8*(T-273)+32 :REM
CONVERT DEG K TO DEG F
•40 DEF FNF2K(T)=273+(T-32)/1.8 :REM
CONVERT DEG F TO DEG K
•50 DEF FNT(R)=1/(1/T0+(1/B)*LOG(R/R0)) :
REM TEMP IN DEG K
•60 GOSUB 3000 :REM GET CALIBRATION
CONSTANTS
•70 PRINT "PUT THERMISTOR AT NEW TEMPERAT
URE"
•80 PRINT "PRESS ANY KEY WHEN READY"
•90 GET K\$: IF K\$="" THEN 90
•95 REM ----- MAIN LOOP -----
•100 R=POT(1)
•110 T=FNT(R) :REM TEMP IN DEG K
•120 PRINT "TEMPERATURE :";FNR(FNK2F(T));
"DEG F ";
•130 PRINT FNR(T-273); "DEG C"
•140 GOTO 100
•1000 REM ----- WAIT FOR SETTLING -----
•1010 PRINT "PRESS A KEY WHEN VALUE HAS S
ETLED :"
•1020 P1=POT(1)
•1030 PRINT P1;
•1040 GET K\$: IF K\$="" THEN 1020
•1050 RETURN
•2000 REM ----- AVERAGE VALUES -----
•2010 SUM=0
•2020 FOR N=1 TO 10
•2030 P1=POT(1)
•2040 SUM=SUM+P1: NEXT
•2050 RN=SUM/10
•2060 RETURN
•3000 REM ----- GET CALIB. CONSTANTS -----
•3010 PRINT "[CLEAR]DO YOU KNOW CALIBRATI
ON CONSTANTS (Y/N)": INPUT K\$
•3020 IF K\$="N" THEN 3070 :REM CALIBRATE
•3030 INPUT "WHAT IS B"; B

THERMAL CONNECTION FROM PAGE 32

C-64 PADDLE ROUTINE

```
1 REM======  
3 REM C-64 PADDLE ROUTINE  
4 REM RUPERT REPORT #55  
5 REM  
6 REM MONITOR LISTING  
8 REM======  
9 REM DISABLE INTERRUPTS (LINE 90)  
10 REM SAVE CIA DDR (LINE 100)  
11 REM SET BITS 7 & 6 OF CIA  
12 REM #1 AS OUTPUTS (110-120)  
13 REM ENABLE POTS A AND B (130)  
14 REM PUT DELAY COUNT IN X (140)  
15 REM DELAY LOOP (150-170)  
16 REM READ POT X (180)  
17 REM STORE POT X IN 251 (190)  
18 REM READ POT Y (200)  
19 REM STORE POT Y IN 252 (210)  
20 REM RESTORE CIA DDR (220)  
21 REM ENABLE INTERRUPTS (230)  
22 REM BACK TO BASIC (240)  
23 REM======  
90 "OC000 78 SEI  
100 "OC001 AC 02 DC LDY $DC02  
110 "OC004 A9 C0 LDA #$C0  
120 "OC006 8D 02 DC STA $DC02  
130 "OC009 8D 00 DC STA $DC00  
140 "OC00C AA TAX  
150 "OC00D EA NOP  
160 "OC00E CA DEX  
170 "OC00F 10 FC BPL $C00D  
180 "OC011 AD 19 D4 LDA $D419  
190 "OC014 85 FB STA $FB  
200 "OC016 AD 1A D4 LDA $D41A  
210 "OC019 85 FC STA $FC
```

3040 INPUT "WHAT IS T0"; T0
 3050 INPUT "WHAT IS R0"; R0
 3060 GOTO 3270 :REM RETURN
 3070 PRINT "PUT THERMISTOR AT ROOM TEMP"
 3080 INPUT "WHAT IS ROOM TEMP (DEG F)"; T1
 3090 GOSUB 1010 :REM DISPLAY RESISTANCE
 3100 GOSUB 2010 :REM RETURN VALUE
 3110 R1=RN
 3120 PRINT: PRINT "PUT THERMISTOR IN ICE
 WATER"
 FF 3130 PRINT "PRESS ANY KEY WHEN READY"
 JF 3140 GET K\$: IF K\$="" THEN 3140
 CE 3150 GOSUB 1010
 JH 3160 GOSUB 2010
 NE 3170 R0=RN
 FH 3180 T1=FNF2K(T1): T0=273
 PL 3190 PRINT: PRINT "[38"="]"
 JL 3200 B=LOG(R1/R0)/(1/T1-1/T0)
 M 3210 PRINT "RECORD THESE CALIBRATION CON
 JO STANTS :"
 M 3220 PRINT "B ="; FNR(B)
 JP 3230 PRINT "T0 ="; T0
 M 3240 PRINT "R0 ="; R0
 AE 3250 PRINT "[38"="]"
 : 3260 PRINT "THERMISTOR IS NOW CALIBRATED
 BJ ":" PRINT: PRINT
 N 3270 RETURN
 NG 4990 REM #####
 GF 4991 REM FOLLOWING LINES FOR C-64 ONLY
 KP 4992 REM #####
 JA 4993 REM ADD LINE 11
 FH 4994 REM REPLACE LINES 100, 1020, 2030
 LN 4995 REM ADD LINES 5010-49184
 MM 4996 REM
 HA 5000 REM 11 SA=49152: GOSUB 5010
 OO 5001 REM 100 SYS SA: R=PEEK(251)
 KB 5002 REM 1020 SYS SA: P1=PEEK(251)
 KF 5003 REM 2030 SYS SA: P1=PEEK(251)
 EC 5004 REM=====
 JB 5010 M=49152: CSUM=4609
 FO 5020 READ B\$: IF B\$="XX" THEN 5100
 MB 5030 B=VAL(B\$)
 JE 5040 POKE M,B: M=M+1: CK=CK+B
 JL 5050 GOTO 5020
 KM 5100 IF CK=CSUM THEN RETURN
 JE 5110 PRINT "DATA ERROR. CHECK TYPING."
 END
 LM 49152 DATA 120,172,2,220,169,192,141,2
 JL 49160 DATA 220,141,0,220,170,234,202,16
 HD 49168 DATA 252,173,25,212,133,251,173,26
 HL 49176 DATA 212,133,252,140,2,220,88,96
 FH 49184 DATA XX
 KC
 EM

CM TCHR\$(11)CHR\$(142)CHR\$(147):CHAR,10,5,"[
 AO c 5][s U][4"[s C"]][s I][DOWN][6"[LEFT]"
 NP][s B][4"Z"]][s B][DOWN][6"[LEFT"]][s J][
 4"[s C"]][s K][s Q][DOWN][s W][DOWN][s W
][DOWN].[DOWN]."
 IK NP
 NC
 EM
 LO
 AN
 CI
 JF BK
 OG
 KJ JE
 LC
 EK
 FF HE
 EP
 DH
 KH
 OG
 DP
 DN
 ML
 AA PI
 GA
 HO
 NE
 FM
 JA
 LK
 GB
 CE
 ME
 FM
 MD
 DG
 JC
 IE
 NO
 CM
 EE
 BJ
 EN
 OI
 KB
 LB
 MN
 BE
 BE
 KB
 IE

NP
 •20 CHAR,20,12,"[c 8][4"[c @"]][DOWN][5"[
 LEFT"]][s N][s F][s F][s M][DOWN][
 7"[LEFT"]][s N][4"[c +"]"] [c +][s M][DOW
 N][8"[LEFT"]][8"[c U]"]":CHAR,23,10,"(WO
 RKING)"
 •30 FORX=3584T04096:READA\$:POKEX,DEC(A\$):
 NEXT:FORX=4864T05054:READA\$:POKEX,DEC(A\$
):NEXT
 •40 FORX=.T063:POKE55*64+X,.:NEXT:POKE55*
 64+32,192:POKE55*64+35,192:PRINTCHR\$(147
)
 •50 POKE4593,203:POKE4592,100:POKE4595,0:
 POKE4594,30:POKE4602,250:POKE4597,0:POKE
 4598,130:POKE4599,56:SYS4864
 •60 B\$="":FORX=.T039:B\$=B\$+CHR\$(32):NEXT:
 FORX=1T08:MOVSPRX,.#.:NEXT
 •70 TEMPO10:D\$(.)="01":D\$(2)="02":D\$(3)="
 03":D\$(4)="04":D\$(5)="04":D\$(6)="01"
 •80 FORX=4T07:POKE2040+X,62:NEXT:FORX=5T0
 6:SPRITE,.,13,.,1,1,:NEXT:FORX=7T08:SP
 RITE,.,12,.,1,.,.:NEXT:POKE2040+3,63:PO
 KE2041,55:SPRITE2,.,2,.,.,.
 •90 MOVSPR5,30,152:MOVSPR6,250,152:MOVSPR
 7,120,157:MOVSPR8,350,157:FORX=5T06:MOVS
 PRX,270#2:MOVSPRX+2,270#1:NEXT:POKE2040,
 56:SPRITE1,.,14,.,.,.:MOVSPR1,100,198
 •100 POKE2043,60:POKE2042,59:SPRITE3,.,4,
 .,.,1:MOVSPR3,370,150:SPRITE4,.,13,.,1
 ,1,.:MOVSPR4,370,198:MOVSPR4,270#3
 •110 GOSUB380:PRINTCHR\$(27)"M";"[4"[DOWN]
 "]][RVSON][c 4]"B\$B\$"[c 5]"B\$B\$B\$"[c 8]"B
 \$B\$B\$B\$
 •120 DIMD(8),S(1),M\$(2)
 •130 J=.:D=.:G=15:F=127:Z=.:V=1:Q=.:S=.:B
 =.:H=5:P=10:I=5:K=25:U=1:T=2:M=3:L=198:S
 C=.:N=4:Q=240:VIC=53248:S(.)=315:S(1)=22
 5
 •140 A\$="[HOME][5"[DOWN"]][21"[RIGHT"]]"
 B\$="[8"[RIGHT"]]"":M\$(.)=" YOU RECOVERED
 THE BUGGY! ":"M\$(1)=" YOU CRASHED IN A CR
 ATER! ":"M\$(2)=" YOU COLLIDED WITH THE SH
 IP!"
 •150 FORX=1T010:READB\$(X):NEXT
 •160 FORX=.T08:D(X)=-1:NEXT:D(.)=90:D(1)=
 0:D(3)=90:F\$="[5#""]":H\$="[4#""]":SPRCOL
 OR7,3
 •170 DEFFNJ(X)=(C<H)*T+(C>H)*-T+(C=P)*T
 •180 DEFFNF(U)=-(J>FANDD(X)=>.ANDRSprite
 T,.)=:DEFFNC(X)=(J=H)*-U+((JANDG)=H+U)
 -T+((JAND(H+M))>.)-M
 •190 POKEVIC+21,241:X=.:DO:PLAYD\$(X):PLAY
 "T7IG#GGEG#GGE":X=X+1+(X=6)*7:LOOPWHILEJ
 OY(2)<127:WINDOW0,0,39,15,1:PRINT"[HOME]"

LUNAR BUGGY FROM PAGE 15

10 POKE53248+21,.:COLOR0,1:COLOR4,1:PRIN

IMPORTANT! Letters on white background are Bug Repellent line codes. Do not enter them! Pages 61 and 62 explain these codes and provide other essential information on entering *Ahoy!* programs. Refer to these pages before entering any programs!

,CD,F0,11,B0,15,AD,F0,11,9D,D6
 •650 DATA 11,E0,3,D0,1A,A9,FD,2D,15,D0,8D
 ,15,D0,4C,88,13,BD,D6,11,38,CD,F1,11,90,
 6,AD,F1,11,9D,D6,11,CE,F4,11,30
 •660 DATA 3,4C,55,13,CE,F5,11,30,16,AD,F6
 ,11,8D,F5,11,AE,F7,11,E8,E0,3B,D0,2,A2,3
 8,8E,F7,11,8E,F8,7,AD,D8,11,38
 •670 DATA CD,FA,11,90,8,A9,FD,2D,15,D0,8D
 ,15,D0,4C,65,FA
 •680 REM BASES
 •690 DATA I,II,III,IV,V,VI,VII,VIII,IX,X

ID	•440 DATA -144,104,240,16,96,104,173,-21	BM
DF	•450 DATA 208,249,76,40,125,201,5,144	AI
HC	•460 DATA 48,176,242,173,-22,133,236,173	MI
GM	•470 DATA 23,19,133,235,76,92,193,32	DD
LN	•480 DATA 134,3,240,222,32,92,121,76	HD
IO	•490 DATA 90,85,32,-170,164,230,200,232	IP
	•500 DATA 32,-171,200,196,231,208,248,232	NP
	•510 DATA 189,-12,76,12,192,134,195,168	EM
	•520 DATA 169,246,162,19,24,121,-24,144	IE
	•530 DATA 1,232,164,195,133,195,134,196	CF
	•540 DATA 162,26,152,208,22,160,37,136	HJ
	•550 DATA 181,224,145,195,202,16,248,162	GB
	•560 DATA 13,136,189,84,3,145,195,202	LM
	•570 DATA 16,247,96,160,37,136,177,195	LL
	•580 DATA 149,224,202,16,248,162,13,136	CN
	•590 DATA 177,195,157,84,3,202,16,247	DM
	•600 DATA 96,0,999	HB

WINDOW DRESSING FROM PAGE 37

BASIC LOADER

.100 REM *** WINDOW DRESSING LOADER ***
 •110 SA=4864:REM WILL RELOCATE
 •120 CK=0
 •130 READD:CK=CK+D:IFD=999THEN150
 •140 GOTO130
 •150 IFCK<>30632THENPRINT"ERROR IN DATA":
 END
 •160 RESTORE
 •170 NA=SA
 •180 READD:IFD=999THEN230
 •190 IFD=>0THENPOKENA,D:GOTO220
 •200 AD=SA+ABS(D):H=AD/256:L=AD-INT(AD/25
 6)*256
 •210 POKENA,L:NA=NA+1:POKENA,H
 •220 NA=NA+1:GOTO180
 •230 AD=SA+246:H=AD/256:L=AD-INT(AD/256)*
 256
 •240 POKESA+181,L:POKESA+183,H
 •250 PRINT"WINDOW DRESSING INSTALLED"SA" T
 0"NA
 •260 PRINT"SYS"SA"FOR FRAME"
 •270 PRINT"SYS"SA+3"FOR PRINT AT"
 •280 PRINT"SYS"SA+6"FOR CRSR RESTORE"
 •290 PRINT"SYS"SA+9"FOR EDITOR SAVE/RECAL
 L"
 •300 END
 •310 DATA 184,80,26,184,80,86,184,80
 •320 DATA 122,184,80,113,176,192,174,221
 •330 DATA 29,221,173,192,189,0,0,0
 •340 DATA 0,40,80,120,160,32,80,193
 •350 DATA 165,248,133,207,32,229,202,162
 •360 DATA 255,32,-155,164,229,200,132,206
 •370 DATA 32,-155,230,206,164,206,196,228
 •380 DATA 240,5,202,202,202,208,240,32
 •390 DATA -155,32,84,200,32,-144,165,207
 •400 DATA 133,248,230,229,230,230,198,228
 •410 DATA 198,231,32,50,202,76,111,199
 •420 DATA 72,165,236,141,-22,165,235,141
 •430 DATA -23,24,32,24,192,176,7,32

NC	•100 REM WINDOW DRESSING DEMO	GA
LA	•110 GOSUB510	JG
OL	•120 COLORBG,15:COLOR4,15	FA
AG	•130 COLOR5,8:WINDOW0,0,SW-1,4:SYS FR,,, ,M\$;1:SLEEP1:PRINT"[DOWN][RIGHT]AS YOU C AN SEE[3"."]"	OO
KO	•140 SLEEP1:PRINTEQ\$"[RIGHT]THESE ROUTINE S[3"."]":SLEEP1:SYS ED,0,0	PC
IC	•150 COLOR5,14:WINDOW0,5,SW/2-1,24:SYS FR ,,,,M\$;2:SYS ED,1,0	KN
CM	•160 SYS ED,0,1:PRINTEQ\$"[RIGHT]DRESS UP YOUR WINDOWS,"":SLEEP1	HG
IP	•170 COLOR5,2:WINDOWSW/2,5,SW-1,24:SYS FR ,,,,M\$;3:SYS ED,2,0	FO
AL	•180 SYS ED,0,1	JD
LP	•190 PRINTEQ\$"[RIGHT]LET YOUR PROGRAMS[3" .""]":SLEEP1	DO
BB	•200 PRINTEQ\$"[RIGHT]JUMP FROM WINDOW[3" .""]":SLEEP1	HI
BO	•210 SYS ED,1,1:LIST:SYS ED,1,0:SLEEP1	MG
OA	•220 SYS ED,0,1:PRINTEQ\$"[RIGHT]TO WINDOW [3"."]":SLEEP1	DA
LE	•230 SYS ED,2,1:LIST:SLEEP2	DG
NF	•240 SYS ED,0,1:PRINTEQ\$"[RIGHT]PRINT ANY WHERE[3"."]":SLEEP1	PB
CN	•250 SYS ED,1,1:PRINT"[DOWN][RVSON]HERE," ;:SLEEP1:SYS AT,0,12,0,,EQ\$"HERE,";	FC
CG	•260 SLEEP1:PRINT" OR HERE,"":SLEEP1	NO
EO	•270 SYS ED,0,1:PRINTEQ\$"[RIGHT]AND RETUR N."	NM
HJ	•280 SLEEP3	EO
GF	•290 PRINT"[RVSON]";:COLOR5,2	PB
KN	•300 WINDOW4,2,24,20,1:SYS FR,,,,"[3"[RI GHT]""]MENU"	OF
MI	•310 PRINT:PRINT"[RIGHT]1. RESTART":PRINT "[RIGHT]2. THE SHADOW"	DJ
MF		
FP		
IA		
OE		
MC		
JI		
MM		
JA		
JC		
NH		
FM		
MP		

IMPORTANT!

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•320 PRINT"[RIGHT]3. THE TUNNEL":PRINT"[RIGHT]4. QUIT"
•330 PRINT:PRINT:PRINT"[RIGHT]YOUR CHOICE ?";
•340 SYS 52591:REM CRSR ON
•350 GETKEY K$:IF K$<"1" ORK$>"4"THENPRINT "[3"[UP]]":GOTO330
•360 SYS 52639,32:REM CRSR OFF
•370 PRINTK$
•380 K=VAL(K$):ONK GOTO110,410,480
•390 SLOW:END
•400 REM SIMULATE A "FLOATING" WINDOW WITH SHADOW
•410 WINDOW7,8,SW-9,14:PRINT"[BLACK][RVSON]";:AL=PEEK(FA):AH=PEEK(FA+1)
•420 POKEFA,0:POKEFA+1,11:REM POINT TO SPACE CHARACTERS
•430 SYS FR:WINDOW8,7,SW-8,13
•440 COLOR5,8:PRINT"[RVSON]";:SYS FR
•450 POKE FA,AL:POKE FA+1,AH:REM DEFAULT FRAME
•460 SLEEP3:GOTO280
•470 REM TUNNEL
•480 COLOR5,14
•490 FORI=0TO7:SYS FR:NEXT
•500 GOTO280
•510 BG=0:SW=RWINDOW(2)
•520 SA=4864:FR=SA:AT=SA+3:CR=SA+6:ED=SA+9:FA=SA+172
•530 M$="[RIGHT][RVSON]WINDOW":B1$="[9" "]"
•540 FORI=0TO8:POKE2816+I,ASC(MID$(B1$,I+1,1))
•550 NEXT
•560 IFSW=80THENBG=6:FAST
•570 EQ$="[UP]" +CHR$(27)+"Q"
•580 RETURN

```

JG .:NEXT
GD .80 FORX=.TO12STEP3:POKE11*64+29+X,24:NEXT
KP T
MH .90 POKE11*64+35,255:POKESP,11:POKEV,156:
IL POKEV+1,188:POKEV+39,1
LJ .100 FORX=53000TO53223:READA:POKEA,A:NEXT
GO .110 FORX=UTOL:B(X)=2[UPARROW]X:NEXT
EM .120 A\$="[RVSON][c Y][s P][RVSOFF][sEP][U
IP P][3"[LEFT]]":RVSON][sEP][s C][s N][DOWN
KG]":E\$(.):" [UP] [DOWN][DOWN][LEFT] ":E\$(
BN 1) :" [DOWN] :"E\$(2) :" [DOWN] "
BF .130 E\$(3) :" [UP][LEFT] :"E\$(4) :" [UP] [
EM DOWN] :"BL\$="[RVSON][RED]"
IP .140 B\$="[c 4][RVSON]":FORX=.TO19:B\$=B\$+"
KG [s 0][s P]":BL\$=BL\$+CHR\$(32):NEXT:C\$=RIG
BN HT\$(B\$,39)+"[s 0]"
BF .150 I\$(.):" [RVSOFF] :"I\$(1) :" [RVSOFF][c
KH G]":I\$(2) :" [RVSOFF][c H]":I\$(3) :" [RVSOFF
DJ]":I\$(4) :" [RVSOFF][c K]":I\$(5) :" [RV
BN SON][c L]"
GJ .160 I\$(5) :" [RVSON][c N]":I\$(6) :" [RVSON][
DJ c M]":I\$(7) :" [RVSON] ":"V\$="ENEMY DECIMAT
ED[3"."]FORTRESS SAVED!"
IK .170 FORX=.TO39:D\$=D\$+"[s I]":E\$=E\$+"[s K
IP]":NEXT
BN .180 FORX=.TO16:FORA=.TO7:D\$(X*6+A)=LEFT\$
EC (BL\$,X+2)+I\$(A)+" [RVSOFF]":NEXT:NEXT
IP .190 POKEV+16,64+128:FORX=1TO7:POKESP+X,1
OP 3:POKEV+39+X,5:NEXT
EN .200 GOSUB480:GOSUB450:GOSUB460:X=FRE(.)
IP .210 FORX=.TO103:SYSP,9,23:PRINTD\$(X):NEX
KH T
KK .220 X=1:POKEV+K,U:C=PEEK(V+G):C=PEEK(V+G
OG)":SYS53000
BN .230 REM MAIN LOOP
NE .240 F=PEEK(J)ANDN:X=X+U+(X=L)*L:IFT(X)TH
ENT(X)=T(X)-U:IFT(X)=.THENGOSUB290
KH .250 C=RND(U)*M+U:IFC<L+UTHENIFT(C)=.THEN
T(C)=G-INT(I):POKEV+K,PEEK(V+K)ORB(C)
BN .260 C=PEEK(V+G):ON-(F.).GOTO240:GOSUB390
DE :AM=AM+U
DE .265 IFAM=LMTHENAM=.:BM=BM-U:SYSP,27+H*BM
,YS:PRINT"[BLACK]"A\$;:ON-(BM=.)GOTO320
DE .270 ON-(C=.)GOTO240:FORA=UTOL:IF(CANDB(A
))THENGOSUB340
NK .280 NEXT:C=PEEK(V+G):C=PEEK(V+G):GOTO240
HA .290 SYSP,RND(U)*XC,RND(U)*H+YC:PRINTES(R
ND(U)*E);:POKEQ+X,W:GOSUB400:GOSUB390
BJ .300 DM=DM-U:SYSP,9,23:PRINTD\$(DM)":"FOR
A=.TON:POKEV+G+H,A:NEXT:A=X:IFDMGOTO380
MH .310 POKE5+18,129:FORX=.TO400:POKES+15,RN
D(.)*Z:POKEV+33,XANDG:NEXT:GOSUB450
BH .320 POKEV+21,:PRINT"[CLEAR][5"[DOWN]]"
NB :PRINTTAB(4)"[c 3]OUR FORTRESS HAS BEEN
DESTROYED!"
.330 PRINTTAB(12)"[c 5][3"[DOWN]]FINAL S

GUERILLA FROM PAGE 16

```

•10 POKE53281,..:POKE53280,..:PRINTCHR$(8)C  

HR$(142)"[CLEAR][7"[DOWN]]"TAB(15)"[PUR  

PLE]GUERILLA"
•20 PRINTTAB(8)"[CYAN][DOWN][DOWN](C)1988  

CLEVE BLAKEMORE"
•30 DIM T(7),B(7),E$(4),D$(103),I$(7)
•40 V=53248:SP=2040:J=56320:S=54272
•45 M=90:I=1:N=16:C=.:G=30:U=1:L=7:P=5318
O:AM=.:BM=4:TH=.:LM=50
•50 K=21:B=255:W=13:Q=V+39:R=2:E=5:XC=37:  

YC=19:H=3:XS=7:YS=24:Z=150:LV=1:DM=103
•60 FORX=2TO15:READA:POKEV+X,A:NEXT:FORX=.  

TO127:READA:POKE832+X,A:NEXT
•70 FORX=.TO63:POKE11*64+X,..:POKE15*64+X,

```

GB	•340 POKESP+A,W+U:POKEQ+A,R:SC=SC+Z*LV:SY SP,XS,YS:PRINT"[WHITE][RVSOFF]"SC;:M+= (M>L)	IE	[RVSON] [c 4] [c 8] [c 1][s P][s 0][s P][s 0][s P][RVSOFF][3" "][RVSON][s P][s 0][s P][c 2] "	KC
BC	•350 IFI<26THENI=I+.5	DJ	•540 PRINT"[RIGHT][RIGHT][c 5][RVSON] [6" [c S"]][RVSOFF][3" "][RVSON] [c 8] [RVSOFF] [c 2][c *][RVSON] [RVSOFF][sEP] [c 1][RVSON][s P][c 4] [c 8] [c 1][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2] "	
FC	•360 IFI=10ORI=180RI=25THENLV=LV+U:POKE20 05,48+LV:GOSUB420	EN	•550 PRINT"[RIGHT][RIGHT][c 5][RVSON] [6" [c S"]][RVSOFF][3" "][RVSON] [c 8] [RVSOFF] [c 2][RVSON][c H][c L][RVSOFF] [c 1][RVSON][s 0][c 4] [c 1][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2] "	FA
BB	•370 TH=TH+U:IFTH=ZTHENPOKEV+21,.:PRINT"[CLEAR][6"[DOWN]"]"TAB(11)V\$:GOSUB420:GOT 0330	KM	•560 PRINT"[RIGHT][RIGHT][c 5][RVSON] [9" [c S"]][c 8] [RVSOFF] [c 2][RVSON][c G][c N][RVSOFF] [c 1][RVSON][s P][s 0][s P][c 2] "	CC
PH	•380 GOSUB410:POKEV+K,PEEK(V+K)AND(B-B(A)):POKESP+A,W:POKEQ+A,E:T(A)=.:RETURN	KF	•570 PRINT"[RIGHT][GREEN][c -][c 5][RVSON] [RVSOFF][3" "][RVSON][6"[c S"]][c 8] [GREEN][RVSOFF][c -][c 2][RVSON][s Q][c L][RVSOFF] [c 1][RVSON][s 0][s P][s 0][RVSOFF][3" "][RVSON][s 0][s P][s 0][s P][RVSOFF][3" "][RVSON][s P][s 0][s P][c 2] "	BB
MJ	•390 POKES+8,4:POKES+11,129:FORA=.T050:NE XT:POKES+11,128:RETURN	MC	•580 PRINT"[GREEN][c -][c -][c 5][RVSON] [RVSOFF][3" "][RVSON][6"[c S"]][c 8] [GREEN][RVSOFF][c -][c -][c 2][RVSON][c H][c M][RVSOFF] [c 1][RVSON][s P][s 0][s P][RVSOFF][3" "][RVSON][s P][s 0][s P][s 0][RVSOFF][3" "][RVSON][s 0][s P][s 0][s P][c 2] "	BD
PG	•400 POKES+18,129:FORA=ZTO.STEP-E:POKES+1 5,A:NEXT:POKES+18,128:RETURN	EF	•590 PRINT"[GREEN][c -][RVSON][c +][c 5] [RVSOFF][3" "][RVSON][6"[c S"]][c 8] [GREEN][c +][RVSOFF][c EP][c 2][RVSON] [RVSOFF] [c 1][RVSON][s 0][s P][s 0][RVSOFF][3" "][RVSON][s P][s 0][s P][RVSOFF][3" "][RVSON][s 0][s P][s 0][s P][c 2] "	00
JA	•410 FORD=.TOZ:NEXT:RETURN	PM	•600 PRINT"[GREEN][c +][c +][c 5][RVSON] [9"[c S"]][c 8] [GREEN][c +][RVSOFF][c +][c 2][RVSON][c M][RVSOFF] [c 1][RVSON][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2] "	KN
NM	•420 M\$="251331421502421502":GOSUB450:POK ES+6,96:FORLL=1TO18STEP3	MC	•610 PRINT"[GREEN][RVSON][c +][RVSOFF][c +][c 5][RVSON] [6"[c S"]][RVSOFF][3" "][RVSON] [c 8] [GREEN][RVSOFF][c +][RVSON][c +][RVSOFF][c -][c 1][RVSON][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2] "	AD
EJ	•430 POKES+1,VAL(MID\$(M\$,LL,2)):POKES+4,1 7:FORD=1TO90*VAL(MID\$(M\$,LL+2,1)):NEXT	DH	•620 PRINT"[GREEN][c +][RVSON][c +][c 5] [6"[c S"]][RVSOFF][3" "][RVSON] [c 8] [GREEN][4"[c +"]][RVSOFF][c +][RVSON][c +][c 1][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2] "	HN
BF	•440 POKES+4,16:NEXT:GOSUB450:GOSUB460:RE TURN	PN		
GD	•450 FORLL=STOS+23:POKELL,.:NEXT:POKES+24 ,15:RETURN	GK		
JF	•460 POKES+6,73:POKES+13,234:POKES+20,234 :RETURN	KH		
GD	•470 REM GAME SCREEN	DB		
IJ	•480 PRINT"[CLEAR][5"[RIGHT]""][c 8][RVSON][5" "][WHITE][c *]"	CF		
ND	•490 PRINT"[5"[RIGHT]""][c 8][RVSON] [RVSO FF][3" "][RVSON] [WHITE] [RVSOFF] [GREE N][cEP] [cEP] [3"[cEP]""] [c 5][RVSON] [c 4][c *][RVSOFF][3" "][c 1][RVSON][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2]"	PI		
OE	•500 PRINT"[5"[RIGHT]""][c 8][RVSON] [RVSO FF][3" "][RVSON] [WHITE] [RVSOFF] [GREEN][cEP][cEP][c +][cEP][c +][cEP][c +][cEP][c +][c 5][RVSON] [c 4] [c *][RVSOFF][c 1][RVSON][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2]"	LB		
HO	•510 PRINT"[5"[RIGHT]""][c 8][RVSON] [RVSO FF][3" "][RVSON] [WHITE] [RVSOFF] [GREEN][cEP][cEP][c -][c +][cEP][c +][cEP][c +][cEP][c +][c 5][RVSON] [c 4] [c *][RVSOFF][c 1][RVSON][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][s 0][s P][c 2]"	AI		
IA	•520 PRINT"[RIGHT][RIGHT][c 5][RVSON] [9" [c S"]][c 8][c *][c 2][RVSOFF][s M][s V][s V][s N][s M][s V][s V][c 5][RVSON] [c 4] [c 8] [c 1][s 0][s P][s 0][s P][s 0][RVSOFF][3" "][RVSON][s 0][s P][s P][c 2]"	HL		
BD	•530 PRINT"[RIGHT][RIGHT][c 5][RVSON] [6" [c S"]][RVSOFF][3" "][RVSON] [c 8] [c *][c 2][c I] [c *][sEP] [RVSOFF][s 0][c 5]			

```

][s 0][c 2] "
•630 PRINT"[GREEN][c +][c +][c 5][RVSON]
[6"[c S"]][RVSOFF][3" "][RVSON] [c 8] [
GREEN][c +][RVSOFF][c +][RVSON][4"[c +]"
][c 1][s 0][s P][s 0][s P][s 0][s P][s 0]
][s P][s 0][s P][s 0][s P][s 0][s P][s 0]
][s P][c 2] "
•640 PRINT"[c 5]"D$E$B$C$B$C$B$;"[RVSOFF]
[WHITE]GUERRILLA"
•650 PRINT"[c 8]SCORE [WHITE]=[7" ""][c 7]
ATTACK [WHITE]1[RIGHT][c 5]AMMO[c 2]"A$A
$A$A$;"[HOME]":RETURN
•660 REM SPRITE LOCATION DATA
•670 DATA96,93,72,61,48,125,96,158,217,12
6,17,126,17,78:REM V+16=64+128
•680 REM SPRITE DATA
•690 DATA1,252,,3,254,,7,199,,7,56,128,6,
221,128,1,125,.
•700 DATA6,21,,4,46,128,4,29,96,12,35,104
,28,62,220,60,62,62
•710 DATA124,56,31,124,54,15,121,45,15,11
4,155,239,4,87,239,10,175,222
•720 DATA19,215,156,32,107,124,193,245,12
0,,,,126,18,15,195,9,23
•730 DATA97,36,63,225,18,63,225,8,51,222,
1,179,128,7,222,180,15,225
•740 DATA110,31,126,223,62,252,191,61,248
,95,1,240,95,126,104,95,185,216
•750 DATA223,85,183,190,147,110,136,16,22
1,240,3,187,240,4,117,80,15,250,80,.
•760 REM INTERRUPT ROUTINE
•770 DATA 120,169,31,141,20,3,169,207,141
,21,3,169,166,141,17
•780 DATA 3,169,207,141,18,3,88,96,173,,2
20,41,15,133,253
•790 DATA 169,15,56,229,253,168,185,221,2
07,240,8,141,168,2,160
•800 DATA 0,32,60,207,76,163,207,173,168,
2,10,170,189,202,207
•810 DATA 8,152,10,170,40,48,25,240,43,17
3,220,207,24,125,0
•820 DATA 208,157,,208,144,31,169,1,77,16
,208,141,16,208,76
•830 DATA 120,207,189,,208,56,237,220,207
,157,,208,176,8,169
•840 DATA 1,77,16,208,141,16,208,173,168,
2,10,170,232,189,202
•850 DATA 207,8,152,10,170,232,40,48,15,2
40,23,173,220,207,24
•860 DATA 125,,208,157,,208,76,162,207,18
9,,208,56,237,220
•870 DATA 207,157,,208,96,76,49,234,173,,2
20,41,15,133,253
•880 DATA 169,15,56,229,253,168,185,221,2
07,168,169,,108,5,0
•890 DATA 32,155,183,138,72,32,155,183,10

```

CO	4,168,24,76,240,255,0	MC
	•900 DATA 0,,255,1,255,1,,1,1,,1,255,1,25	
	5,0	MB
	•910 DATA 255,255,3,,1,5,,7,8,6,,3,2,4	KF
TOMB OF HORROR		
FROM PAGE 48		
GM		
EC		BASIC PORTION
MK	•10 IFX=.THENX=1:LOAD"TOMB.OBJ",8,1	HH
HG	•20 POKE56,144:POKE55,0:CLR	BD
LJ	•30 POKE53280,,.:POKE53281,,:X=RND(-TI):FO	MJ
CD	RX=901T0970:READA:POKEX,A:NEXT	
IG	•40 FORX=828T0839:READA:POKEX,A:NEXT:FORX	
AG	=679T0753:READA:POKEX,A:NEXT:GOTO790	AG
HA	•50 D=RND(U)*G:POKES+K,U(D):POKES+7,V(D):	DM
	POKES+G,U(D+K+F):POKES+G-U,V(D+K+F)	
EM	•60 RETURN	MK
HK	•70 VL=FC:ONFC+UGOSUB450,450,460,470,480	DN
FH	•80 RETURN	NO
JE	•90 ONFC+UGOSUB500,510,520,530:RETURN	LJ
IG	•100 ONFC+UGOSUB540,550,560:RETURN	CL
IN	•110 PRINT"[HOME][BLACK][RVSON] +[36" "]/	FG
LB	";	
AL	•120 PRINT" [RVSOFF][36"[SS]"][RVSON] "	AI
NJ	;	
KN	•130 PRINT" [RVSOFF][36"[SS]"][RVSON] "	DC
MI	;	
AG	•140 PRINT" [RVSOFF][36"[SS]"][RVSON] "	DM
II	;	
FF	•150 PRINT" [RVSOFF][36"[SS]"][RVSON] "	FG
MF	;	
CL	•160 PRINT" [RVSOFF][4"[SS]"]"Z\$"[RVSON]	
IN	([BLACK][26" "]"Z\$")[BLACK][RVSOFF][4"[S	LB
	S])[RVSON] ";	
AL	•170 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	JF
NJ	"Z\$(([BLACK][24"]="Z\$")[BLACK][SS][RVSO	
KN	FF][4"[SS"]][RVSON] ";	
MI	•180 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	BJ
AG	[SS] +[20" "]/ [SS][SS][RVSOFF][4"[SS"]]	
II	[RVSON] ";	
FF	•190 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	LO
MF	[SS] [RVSOFF][20"[SS"]][RVSON] [SS][SS]	
CL][RVSOFF][4"[SS"]][RVSON] ";	
IN	•200 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	PP
	[SS] [RVSOFF][SS][SS]"Z\$"[RVSON)(([BLACK]	
][14"="]"Z\$")[BLACK][RVSOFF][SS][SS][RVSO	
	ON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";	
	;	
	•210 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	
	[SS] [RVSOFF][SS][SS][RVSON][SS]+[12" "]	
][SS][RVSOFF][SS][SS][RVSON] [SS][SS][RVSO	
	FF][4"[SS"]][RVSON] ";	
	•220 PRINT" [RVSOFF][4"[SS]"][RVSON][SS]	PH
	[SS] [RVSOFF][SS][SS][RVSON][SS] [RVSO	
	FF][12"[SS"]][RVSON] [SS][RVSOFF][SS][SS]	

TOMB OF HORROR

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BASIC PORTION

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10 IFX=.THENX=1:LOAD"TOMB.OBJ",8,1
20 POKE56,144:POKE55,0:CLR
30 POKE53280,..:POKE53281,..:X=RND(-TI):FO
RX=901T0970:READA:POKEX,A:NEXT
40 FORX=828T0839:READA:POKEX,A:NEXT:FORX
=679T0753:READA:POKEX,A:NEXT:GOTO790
50 D=RND(U)*G:POKES+K,U(D):POKES+7,V(D):
POKES+G,U(D+K+F):POKES+G-U,V(D+K+F)
60 RETURN
70 VL=FC:ONFC+UGOSUB450,450,460,470,480
80 RETURN
90 ONFC+UGOSUB500,510,520,530:RETURN
100 ONFC+UGOSUB540,550,560:RETURN
110 PRINT"[HOME][BLACK][RVSON] +[36" "]/
";
120 PRINT" [RVSOFF][36"[SS]""] [RVSON] "
;
130 PRINT" [RVSOFF][36"[SS]""] [RVSON] "
;
140 PRINT" [RVSOFF][36"[SS]""] [RVSON] "
;
150 PRINT" [RVSOFF][36"[SS]""] [RVSON] "
;
160 PRINT" [RVSOFF][4"[SS]""]"Z$"[RVSON]
([BLACK][26" "]"Z$") [BLACK][RVSOFF][4"[S
S]""] [RVSON] ";
170 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
"Z$"([BLACK][24"="]"Z$") [BLACK][SS][RVSO
FF][4"[SS]""] [RVSON] ";
180 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
[SS] +[20" "]/ [SS][SS][RVSOFF][4"[SS]"]
[RVSON] ";
190 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
[SS] [RVSOFF][20"[SS]""] [RVSON] [SS][SS]
[RVSOFF][4"[SS]""] [RVSON] ";
200 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
[SS] [RVSOFF][SS][SS]"Z$"[RVSON]([BLACK
][14"="]"Z$") [BLACK][RVSOFF][SS][SS][RVS
ON] [SS][SS][RVSOFF][4"[SS]""] [RVSON] "
;
210 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
[SS] [RVSOFF][SS][SS][RVSON][SS]+[12" "
]/[SS][RVSOFF][SS][SS][RVSON] [SS][SS][
RVSOFF][4"[SS]""] [RVSON] ";
220 PRINT" [RVSOFF][4"[SS]""] [RVSON][SS]
[SS] [RVSOFF][SS][SS][RVSON][SS] [RVSOF
F][12"[SS]""] [RVSON] [SS][RVSOFF][SS][SS]

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[RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •230 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][RVSON][SS] [RVSOFF][SS]"Z\$"[RVSON)([BLACK][8"="]Z\$")][BLACK][RVSOFF][SS][RVSON] [SS][RVSOFF][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •240 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS][RVSON][SS] [RVSOFF][SS][RVSON][SS] "Z\$"[RVSOFF][c +][4"[c Z"]][s *][BLACK][RVSON] [SS][RVSOFF][SS][RVSON] [SS][RVSOFF][SS][SS][RVSON] [SS][RVSOFF][4"[SS"]][RVSON] ";
 •250 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS][RVSON][SS] [RVSOFF][SS][RVSON][SS] "Z\$"[RVSOFF][PI][BLACK][4" "]Z\$"[RVSOFF][c *][BLACK][RVSON] [SS][RVSOFF][SS][RVSON] [SS][RVSOFF][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •260 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS][RVSON][SS] [RVSOFF][SS][RVSON][SS] "Z\$"[RVSOFF][PI][BLACK][4" "]Z\$"[RVSOFF][c *][BLACK][RVSON] [SS][RVSOFF][SS][RVSON] [SS][RVSOFF][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •270 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS][RVSON][SS] [RVSOFF][SS]"Z\$"[RVSON)<[BLACK][8" "]Z\$">[BLACK][RVSOFF][SS][RVSON] [SS][RVSOFF][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •280 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS][RVSON][SS]/[12" "+[SS][RVSOFF][SS][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •290 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] [RVSOFF][SS][SS]"Z\$"[RVSON)<[BLACK][14" "]Z\$">[BLACK][RVSOFF][SS][SS][RVSON] [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •300 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS] /[20" "]+ [SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •310 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] [SS]/[22" "]+[SS][SS][RVSOFF][4"[SS"]][RVSON] ";
 •320 PRINT" [RVSOFF][4"[SS"]][RVSON][SS] "Z\$<[BLACK][24" "]Z\$">[BLACK][SS][RVSOFF][4"[SS"]][RVSON] ";
 •330 PRINT" [RVSOFF][4"[SS"]]"Z\$"[RVSON]<[BLACK][26" "]Z\$">[BLACK][RVSOFF][4"[SS"]][RVSON] ";
 •340 PRINT" /[36" "]+ ";
 •350 PRINTD\$B\$D\$I\$(DL(CL,T))TAB(G+H)"[WHITE]"D\$(CD*-(CU=G))"[c 3]";
 FI HF NP FE EP HB JI BJ IM EK BP MB BI LG
 •360 PRINTTAB(39-LEN(T\$(DL(CL,U))))T\$(DL(CL,U));:SYSRL:RETURN EN
 •370 PRINT"[HOME][RVSOFF][DOWN] "FORX=.TO20:PRINT" ":NEXT:RETURN GC
 •380 PRINT"[HOME][RVSOFF][7"[DOWN]]":FOR X=.TO10:PRINTTAB(8)" ":NEXT:RETURN FN
 •390 PRINT"[HOME][RVSOFF][11"[DOWN]]":TAB(13)" [DOWN][LEFT]";:FORX=.TOF:PRINT" [DOWN][LEFT]";:NEXT:RETURN EH
 •400 PRINT"[HOME][13"[DOWN]]":TAB(16)" [DOWN][LEFT] [DOWN][LEFT] "":RETURN CE
 •410 PRINT"[HOME][RVSOFF]":FORX=.TO21:PRINTTAB(39)CHR\$(20)CHR\$(32):NEXT:RETURN PN
 •420 PRINT"[HOME][RVSOFF][7"[DOWN]]":FOR X=.TO10:PRINTTAB(30)" ":NEXT:RETURN AA
 •430 PRINT"[HOME][10"[DOWN]]":FORX=.TO5:PRINTTAB(26)" ":NEXT:RETURN BO
 •440 PRINT"[HOME][RVSOFF][13"[DOWN]]":TAB(23)" [DOWN][LEFT] [DOWN][LEFT] "":RETURN MM
 •450 PRINT"[HOME][5"[DOWN]]":FORX=.TO17:PRINTTAB(6)W1\$":NEXT:RETURN IO
 •460 PRINT"[HOME][9"[DOWN]]":FORX=.TO9:PRINTTAB(12)W2\$":NEXT:RETURN BP
 •470 PRINT"[HOME][11"[DOWN]]":FORX=.TO5:PRINTTAB(15)W3\$":NEXT:RETURN PI
 •480 PRINT"[HOME][13"[DOWN]]":FORX=.TOT:PRINTTAB(17)W4\$":NEXT:RETURN ED
 •490 RETURN HJ
 •500 PRINT"[HOME][23"[DOWN]]":TAB(13)S1\$":RETURN MP
 •510 PRINT"[HOME][20"[DOWN]]":TAB(15)S2\$":RETURN IB
 •520 PRINT"[HOME][17"[DOWN]]":TAB(17)S3\$":RETURN JD
 •530 PRINT"[HOME][16"[DOWN]]":TAB(18)S4\$":RETURN IH
 •540 PRINT"[HOME]"TAB(13)E1\$":RETURN MG
 •550 PRINT"[HOME][7"[DOWN]]":TAB(15)E2\$":RETURN ON
 •560 PRINT"[HOME][10"[DOWN]]":TAB(17)E3\$":RETURN FB
 •570 IF(DL(CL,.)ANDB(F+H))=.THEN610 MF
 •580 SB=PEEK(V+21):POKEV+21,.:GOSUB2730:GOSUB2510:DL(CL,.)=(DL(CL,.)ANDG) GH
 •590 X=INT(RND(U)*10*(DL+U)):C\$(1)="YOU TAKE"+STR\$(X)+" HP DAMAGE!":AA=18:N=1 EI
 •600 LF=LF-X:GOSUB2570:GOSUB3120:FORX=.TO2000:NEXT:GOSUB2880:POKEV+21,SB OA
 •610 PRINTD\$TAB(G+H)"MOVE!"::CEM=FNTE(.):POKESE,CEM:GOSUB110:PRINTZ\$; JA
 •620 FC=F:VL=FC:LV=CD-U+F*-(CD=U):RV=CD+U+F*(CD=F) JL
 •630 EBM=FNCP(.):IFEBM>.ANDEBM<DETHE650 JD
 •640 FC=FC-U:ON-(FC>-U)GOTO630:RETURN KK
 •650 EL=FNCP(LV):ER=FNCP(RV):IFDL(EBM,.)THEN670 FB
 •660 GOSUB70:FC=FC-U:ONU-(FC<.)GOTO630,71

670 IFDL(EL,.)ANDFC<FTHENONFC+UGOSUB370,
 380,390,400
 680 IFDL(ER,.)ANDFC<FTHENONFC+UGOSUB410,
 420,430,440
 690 FORD=.TOH:IF(DL(EBM,.)ANDB(D))THENON
 DGOSUB90,100,70:PRINTZ\$;
 700 PRINT"[RVSOFF]";:NEXT:FC=FC-U:IFFC>-
 UTHEN630
 710 GOSUB720:CSM=FNSW(.):POKEV+24,(PEEK(
 V+24)AND15)ORCSM:POKEV+21,EL:RETURN
 720 IFFCANDVLTHENVL=VL-U
 730 D=191:POKEFNMP(U),D:POKEFNMP(T),D:PO
 KEFNMP(H),D:POKEFNMP(F+U),D
 740 EL=.:ER=.:POKEV+21,.:FORX=VLTO.STEP-
 U:FC=FNCM(X):IFDL(FC,U)=.THEN780
 750 FC=ABS(DL(FC,U)-U):EL=(ELORSP(X+F))
 760 MB=SP(X)-U:FORD=UTOLEN(SB\$(X,FC)):PO
 KEFNMP(MB+D),ASC(MID\$(SB\$(X,FC),D,U))
 770 POKEBC+SP(X)+D,CS(FC):NEXT
 780 NEXT:SB=EL:RETURN
 790 PRINTCHR\$(147)CHR\$(8)CHR\$(142)"[BLUE
]STAND BY[4"."]":GOSUB2900:GOSUB2980
 800 DIMDL(383,3),B(15),SP(7),SB\$(3,12),D
 \$(4),CS(12),L\$(6),I(30),M(24),MH(24)
 810 DIMCM\$(14),T\$(13),I\$(30),C\$(30),C(30
),M\$(44),LV(2,2),CZ\$(2),H(8),SM\$(8)
 820 DIMTS(24),U(26),V(26)
 830 FC=.:CL=17:CD=2:VL=.:EL=.:ER=.:VS=.:
 LF=20:M=.:W=.005:Z=.94:WL=17
 840 TL=388:TGL=16:CSM=.:CEM=192:DE=383:V
 =53248:SB=.:RL=828:SE=648:SR=679
 850 U=1:T=2:H=3:F=4:K=8:G=15:JOY=56320:D
 L=.:DM=.:AR=.:CU=.:WE=.
 860 S=54272:BC=V+38:SS=.:SC=.:CC=55296:S
 Z=959:I=.
 870 D(1)=1:D(2)=16:D(3)=-1:D(4)=-16
 880 H(.)=1:H(1)=10:H(2)=2:H(3)=2:H(4)=1:
 H(5)=7:H(6)=3:H(7)=13:H(8)=5
 890 SP(.)=.:SP(1)=4:SP(2)=6:SP(3)=7:SP(4
)=15:SP(5)=48:SP(6)=64:SP(7)=128
 900 D\$(.)=" ? ":"D\$(1)="EAST ":"D\$(2)="S
 OUTH":D\$(3)="WEST ":"D\$(4)="NORTH"
 910 SM\$(.)="[EP][EP]":FORX=1TO8:SM\$(X)=C
 HR\$(32)+CHR\$(32):NEXT:CR\$=CHR\$(13)
 920 FORX=.TO38:W\$=W\$+CHR\$(160):B\$=B\$+CHR
 \$(32):MB\$=MB\$+"*":NEXT
 930 D\$="[HOME][c 8][RVSOFF]":FORX=.TO23:
 D\$=D\$+"[DOWN)":NEXT
 940 W1\$=LEFT\$(W\$,28):W2\$=LEFT\$(W\$,16):W3
 \$=LEFT\$(W\$,10):W4\$=LEFT\$(W\$,6)
 950 S1\$="[RVSON][BLACK]"+LEFT\$(W\$,12)+"
 ("S2\$="[RVSON][BLACK]"+LEFT\$(W\$,8)+"(" CC
 960 S3\$="[RVSON][BLACK]"+LEFT\$(W\$,4)+"(" FB
 ":"S4\$="[RVSON][BLACK]"+LEFT\$(W\$,2)+"(" FB
 970 E1\$="[RVSON][BLACK]>"+LEFT\$(W\$,12)+"
 <":E2\$="[RVSON][BLACK]>"+LEFT\$(W\$,8)+"<" IM

CI 980 E3\$="[RVSON][BLACK]>"+LEFT\$(W\$,4)+"<
 LJ ":"CZ\$(.)=[c 4]":CZ\$(1)=[BLUE]":CZ\$(2)=
 "[c 2]"
 AO 990 I\$(.)=LEFT\$(B\$,15):T\$(.)=LEFT\$(B\$,13
)
 HE 1000 DEF FNCP(X)=FC*D(CD)+(CL+D(X)):DEF
 FNSW(X)=(TGL-CSM)
 LD 1010 DEF FNTE(X)=(TL-CEM):DEF FNCM(X)=X*
 D(CD)+CL:DEF FNMP(X)=CEM*256+1016+X
 ID 1020 DEFFNJ(X)=(G-(XANDG)):DEF FNC(X)=(LF
 <K)*-T+(LF>KANDLF<G)*-(F+H)
 MO 1030 DEFFNCD(X)=CD+(CD=F+U)*F+(CD=.)*-F:
 DEFFNJF(X)=((JYAND(G+U))=.)
 HK 1040 DEFFNH(A)=(AR+I(AR)*T+LF/K)
 JH 1050 FORX=.TO15:B(X)=2[UPARROW]X:NEXT
 OJ 1060 FORX=.TODE:READD:DL(X,.)=D:NEXT:FOR
 X=.TO15:READA:POKEV+X,A:NEXT
 BC 1070 FORX=1TO13:READT\$(X):NEXT:FORX=.TO2
 4:READA:M(X)=A:NEXT
 HA 1080 FORX=.TO12:READCS(X):NEXTX:FORX=.TO
 24:READTS(X):NEXT
 HN 1090 FORX=.TO6:FORA=.TO3:SB\$(A,X)=CHR\$(3
 2+X):NEXTA,X
 OG 1100 FORX=7TO12:FORA=.TO3:READSB\$(A,X):N
 EXTA,X
 OE 1110 FORX=.TO1:SB\$(X,.)=CHR\$(191)+CHR\$(3
 2):NEXT
 KK 1120 FORX=1TO30:READI\$(X):NEXT:FORX=1TO1
 4:READCM\$(X):NEXT
 MN 1130 FORX=.TO2:FORA=.TO2:READLV(X,A):N
 EXTA,X:FORX=1TO44:READM\$(X):NEXT
 LP 1140 J=1:FORD=.TOT:FORX=.TOK-U
 PM 1150 A=INT(RND(U)*96+(D*128+16)):ON-(DL(
 A,.)=.)GOTO1150:DL(A,U)=M(J):M(J)=A
 HH 1160 MH(J)=J*F*(D+U):J=J+U:NEXT:NEXT:FOR
 X=.TO63:POKE61376+X,.:NEXT
 LM 1170 FORD=.TOT:FORX=.TO10
 DM 1180 A=INT(RND(U)*96+(D*128+16)):ON-(DL(
 A,.)=.)GOTO1180:DL(A,.)=DL(A,.)ORB(7)
 DJ 1190 NEXT:NEXT
 DM 1200 FORX=.TO26:A=2703*(2[UPARROW]((X-20
)/12)):IFA>65535THENA=65535
 AJ 1210 U(X)=INT(A/B(K)):V(X)=A-U(X)*B(K):N
 EXT
 AG 1220 DL(WL,T)=U:DL(WL,H)=U:DL(WL+16,T)=1
 0:DL(WL+16,H)=U
 ON 1230 PRINTCHR\$(147)CHR\$(14):POKEV+21,.:P
 OKEV+23,127:POKEV+29,15
 LB 1240 POKEV+17,PEEK(V+17)OR64:GOSUB2890:G
 OSUB610
 GP 1250 SS=144:SC=148:GOSUB2730
 1260 C\$(U)=M\$(31):BO\$=[c 4]:MC\$=[WHIT
 E]":N=U:GOSUB2540:GOSUB2880:GOSUB3050:IT
 =IT+1000
 CC 1270 JY=PEEK(JOY):J=FNJ(JY):B=DL(CL,U):I
 FB>.THENIFRND(U)+B/50>ZTHENGOSUB1590
 FB 1280 ON-(RND(U)>Z)GOSUB50:ON-(FNJF(J)AND

AR>.)GOSUB1630	PN	• 1630 ON-(B=.ORCU=20)GOTO80:E=CL:DM=FNH(.):X=.	DD
• 1290 IFJTHENONJGOSUB1380,1460,80,1490,80,80,80,1500	DK	• 1640 ON-(MH(X)=.)GOTO1790:ON-(E<>M(X))GOTOT01790:MH(X)=MH(X)-DM:GOSUB3120	AO
• 1300 POKEV+K*F,FNC(.):LF=LF+W:ON-(TI>IT)GOSUB1510:ON-(LF>.)GOTO1270	NO	• 1650 FORD=FTOK:WAITV+17,128:POKEV+34,H(D):POKEV+35,H(D):NEXT:GOSUB2890	IE
• 1310 J=.:D=.:FORX=UTO100:POKE63488+32*K+RND(U)*K,RND(U)*255+U:NEXT	FP	• 1660 ON-(MH(X)>.)GOTO1790:MH(X)=.:DL(E,U)=.:M(.)=.	AF
• 1320 PRINT"[BLACK][CLEAR]":POKEV+21,.:GOSUB3130:FORX=250T0150STEP-U:SYSSR,.,240,X,.,17,1	PN	• 1670 LV=.:A=-U	DH
• 1330 NEXT:FORX=.T07:POKE63488+32*K+X,.:N EXT:X=.	AB	• 1680 A=A+U:FC=E+D(A)*LV:IFFC<.ORFC>DETHE N1710	MG
• 1340 POKEV+17,PEEK(V+17)AND191	BL	• 1690 IFDL(FC,.)=.ORDL(FC,T)THEN1710	MN
• 1350 C\$(1)=M\$(43+X):C\$(2)=""":C\$(3)=[WHITE][5" "]P L A Y[3" "]A G A I N ?[3" "]	FG	• 1700 DL(FC,T)=TS(X):DL(FC,H)=U+INT(-(TS(X)<G)*RND(U)*H):GOTO1730	JB
• 1360 BO\$="[RED]":MC\$="[c 3]":N=3:GOSUB2560:GOSUB2520:IFI=UTHENPOKES+24,.:RUN30	GP	• 1710 IFA=FTHENA=.:LV=LV+U	EA
• 1370 POKESE,4:POKE679,.:SYS679	DL	• 1720 GOTO1680	BG
• 1380 IFDL(CL+D(CD),.)=.THENGOSUB3120:RET URN	NA	• 1730 FORX=.TOG:FORD=UTOF	DM
• 1390 CL=CL+D(CD):GOSUB570:RETURN	PA	• 1740 POKEBC+D,X:NEXT:NEXT:POKEV+21,PEEK(V+21)AND240	JF
• 1400 ON-(B>.)GOTO80:SB=PEEK(V+21):SS=144 :SC=148:GOSUB2730	IE	• 1750 GOSUB3090:LF=LF+B	CJ
• 1410 GOSUB2710:POKEV+21,.:GOSUB2740:SS=152:SC=156:GOSUB2730	OK	• 1760 X=26+RND(U)*5:I(X)=I(X)+INT(RND(U)*50*B*(LV+U))	JK
• 1420 GOSUB2710:GOSUB2790:ON-(I=G-U)GOTO1450	PL	• 1770 C\$(1)="A "+M\$(22+RND(U)*H)+" "+M\$(25+RND(U)*H)+" OF "+I\$(X)+"."	PB
• 1430 ONIGOSUB1800,1850,1930,1940,1950,1960,2020,2100,2240,2320,2350,2430,2480	FL	• 1780 BO\$="[YELLOW]":MC\$="[WHITE]":N=U:GOSUB2730:GOSUB2880:GOSUB350:RET URN	OD
• 1440 SS=152:SC=156:GOSUB2880:GOTO1420	HO	• 1790 X=X+U:ON-(X<25)GOTO1640:RETURN	PE
• 1450 SS=144:SC=148:GOSUB2880:POKEV+21,SB :X=FRE(.):GOSUB50:RETURN	HC	• 1800 IFDL(CL,T)=.THENC\$(U)="NOTHING HERE !":N=U:BO\$="[PURPLE]":MC\$="[WHITE]":GOSUB2540:RETURN	NJ
• 1460 IFFNJF(.):THEN1400	FN	• 1810 IFDL(CL,T)>14THEN1830	NF
• 1470 IFDL(CL-D(CD),.)=.THENGOSUB3120:RET URN	OH	• 1820 IFI(DL(CL,T))THENC\$(U)="YOU HAVE A "+I\$(DL(CL,T)):N=U:GOSUB2540:RETURN	AE
• 1480 CL=CL-D(CD):GOSUB570:RETURN	KB	• 1830 I(DL(CL,T))=I(DL(CL,T))+DL(CL,H):C\$(U)=I\$(DL(CL,T))+" TAKEN!"	EL
• 1490 CD=CD-U:CD=FNCD(.):GOSUB570:RETURN	EL	• 1840 N=U:BO\$="[WHITE]":DL(CL,T)=.:PRINTD \$I\$(.):GOSUB2540:RETURN	EI
• 1500 CD=CD+U:CD=FNCD(.):GOSUB570:RETURN	EI	• 1850 IFDL(CL,T)THENC\$(U)="NOT ENOUGH ROO M HERE.":N=U:BO\$="[PURPLE]":MC\$="[WHITE]":GOTO2540	DM
• 1510 D=DL*K+U:J=D+K-U:FORX=DTOJ:ON-(MH(X)=.)GOTO1580:A=-U	DM	• 1860 GOSUB2580:IFX=-1THENRETURN	IP
• 1520 IFCL<M(X)-KTHENA=M(X)+D(F)	HP	• 1870 GOSUB2740:GOSUB2790:DL(CL,T)=C(I):DL(CL,H)=I(C(I)):I(C(I))=.	OO
• 1530 IFCL>M(X)+KTHENA=M(X)+D(T)	OO	• 1880 C\$(U)=I\$(C(I))+" DROPPED.":N=U:BO\$=[WHITE]":PRINTD\$I\$(C(I));	IJ
• 1540 IFCL>M(X)ANDCL<M(X)+KTHENA=M(X)+D(U)	JP	• 1890 IFAR=C(I)THENAR=.	FJ
• 1550 IFCL<M(X)ANDCL>M(X)-KTHENA=M(X)+D(H)	FJ	• 1900 IFCU=C(I)THENCU=.	JA
• 1560 IFA<.ORA>DETHEN1580	JA	• 1910 IFWE=C(I)THENWE=.	AD
• 1570 IFDL(A,.)ANDDL(A,U)=.THENDL(A,U)=ABS(DL(M(X),U)):DL(M(X),U)=.:M(X)=A	AD	• 1920 GOSUB2540:RETURN	LP
• 1580 NEXT:ON-(DL(CL,U)>.)GOSUB3030:GOSUB730:POKEV+21,EL:IT=TI+SZ:RETURN	LP	• 1930 GOSUB2630:ON-(N=.)GOTO2530:GOSUB2740:GOSUB2790:AR=C(I):RETURN	CP
• 1590 IFCU=20THENRETURN	CP	• 1940 GOSUB2670:ON-(N=.)GOTO2530:GOSUB2740:GOSUB2790:CU=C(I):RETURN	OD
• 1600 IFWETHENB=B*((G-WE)/10)	OD	• 1950 GOSUB2650:ON-(N=.)GOTO2530:GOSUB2740:GOSUB2790:WE=C(I):RETURN	JN
• 1610 LF=LF-B*T:GOSUB3120:FORX=.TOH:WAITV +17,128:POKEV+34,H(X):POKEV+35,H(X)	OD	• 1960 IF(DL(CL,.)ANDF)=.THENC\$(U)=M\$(29):	CO
• 1620 NEXT:GOSUB2890:POKEV+K*F,FNC(.):RET URN	JN		

BO\$=" [RED]":MC\$=" [YELLOW]":N=U:GOTO2540 MF
 • 1970 IFI(19)=.THENC\$(U)=M\$(30)+I\$(19)+"!
 " :BO\$=" [PURPLE]":MC\$=" [CYAN]":N=U:GOTO25
 40 EN
 • 1980 IFI(17)=.THENC\$(U)=M\$(30)+I\$(17)+"!
 " :BO\$=" [PURPLE]":MC\$=" [c 4]":N=U:GOTO25
 0 JD
 • 1990 ON-(CL<>WL)GOTO2010:IFI(25)=.THENC\$
 (U)=M\$(42):BO\$=" [PURPLE]":MC\$=" [WHITE]":
 N=U:GOTO2540 NC
 • 2000 PRINTCHR\$(147):GOSUB3090:X=U:GOTO13
 40 AA
 • 2010 DL=DL-U:CL=CL-128:A=F:D=50:J=T:GOSU
 B3070:GOTO2060 KB
 • 2020 IF(DL(CL,.)ANDT)=.THENC\$(U)=M\$(28):
 BO\$=" [RED]":MC\$=" [YELLOW]":N=U:GOTO2540 EO
 • 2030 IFI(19)=.THENC\$(U)=M\$(30)+I\$(19)+"!
 " :BO\$=" [PURPLE]":MC\$=" [CYAN]":N=U:GOTO25
 40 JB
 • 2040 IFI(17)=.THENC\$(U)=M\$(30)+I\$(17)+"!
 " :BO\$=" [PURPLE]":MC\$=" [c 4]":N=U:GOTO25
 0 GH
 • 2050 DL=DL+U:CL=CL+128:A=50:D=F:J=-T:GOS
 UB3070 NO
 • 2060 SS=144:SC=148:GOSUB2880:Z\$=CZ\$(DL):
 GOSUB610:GOSUB2890 PN
 • 2070 GOSUB2710:GOSUB2730:GOSUB2740 FI
 • 2080 C\$(U)=M\$(31+DL):BO\$=" [c 4]":MC\$=" [W
 HITE]":N=U:AA=U:SS=152:SC=156:GOSUB2730 JA
 • 2090 GOSUB2540:RETURN FN
 • 2100 PRINTD\$B\$D\$"[YELLOW][RIGHT]"I\$(AR)T
 AB(17)"[RED]HP[YELLOW]"STR\$(INT(LF))TAB(39-
 LEN(I\$(CU)))I\$(CU); LH
 • 2110 IFWETHENC\$(U)=I\$(WE):BO\$=" [c 6]":MC
 \$=" [GREEN]":N=U:AA=19:GOSUB2570 NC
 • 2120 GOSUB2580:IFX=-UTHENGOSUB350:RETURN BP
 • 2130 ONIGOTO2140,2140,2170,2170 CN
 • 2140 GOSUB2740:GOSUB2790:BO\$=" [WHITE]":C
 \$(U)="THE "+I\$(C(I))+ " IS OF"
 • 2150 C\$(T)=M\$(18+I(C(I)))+ " WORKMANSHIP.
 " :AA=K:N=T:LM=28:SM=20-LM/T FO
 • 2160 GOSUB2740:GOSUB2550:GOSUB350:RETURN LC
 • 2170 GOSUB2740:GOSUB2790:IFC(I)=16THEN22
 00 BF
 • 2180 C\$(U)="YOU HAVE"+STR\$(I(C(I)))+ " "+
 I\$(C(I))+". " PC
 • 2190 N=U:BO\$=" [WHITE]":GOSUB2540:GOSUB35
 0:RETURN GF
 • 2200 C\$(U)="UNROLLING PARCHMENT[3"."]":N
 =U:BO\$=" [YELLOW]":MC\$=" [c 2]":GOSUB2560 NN
 • 2210 X=DL*128:J=U:FORA=.TO127STEP16:C\$(J
)="":FORD=.TOG LP
 • 2220 C\$(J)=C\$(J)+SM\$(DL(X+A+D,.)ANDG):NE
 XT:C\$(J+U)=C\$(J):J=J+T FD
 • 2230 NEXT:N=J-U:BO\$=" [c 2]":MC\$=CZ\$(DL):
 GOSUB2540:GOSUB350:RETURN PG
 • 2240 IFCU=.THENC\$(U)="YOU ARE EMPTY HAND
 ED.":N=U:BO\$=" [c 8]":MC\$=" [BLUE]":GOTO25

40
 • 2250 IFCU<21THENC\$(U)="NOTHING HAPPENS."
 :N=U:BO\$=" [c 4]":MC\$=" [c 8]":GOTO2540 MD
 • 2260 C\$(U)=M\$(15+(CU-21)):N=U:BO\$=" [YELL
 OW]":MC\$=" [c 3]":GOSUB2560 GO
 • 2270 IFCU=21ANDDL(CL+D(CD),.):KTHENDL(CL
 +D(CD),.):U HB
 • 2280 J=DL(CL+D(CD),U):IFCU=22AND(J=KORJ=9
 ORJ=13)THEN2380 FP
 • 2290 IFCU=23THENCU=.:I(23)=.:I(24)=U IE
 • 2300 IFCU=24THENI(25)=U:I(24)=.:CU=. ML
 • 2310 GOSUB2550:RETURN BP
 • 2320 IFI(18)=.THENC\$(U)=M\$(34):BO\$=" [c 7
]":MC\$=" [PURPLE]":N=U:GOSUB2540:RETURN NG
 • 2330 I(18)=I(18)-U:LF=LF+10:C\$(U)="YOUR
 BODY IS FLOODED WITH STRENGTH":N=U PF
 • 2340 BO\$=" [c 7]":MC\$=" [WHITE]":GOSUB2540
 :RETURN MC
 • 2350 J=ABS(DL(CL+D(CD),U)):IFJ=.THENC\$(U
)=M\$(35):MC\$=" [YELLOW]":N=U:GOSUB2540:RE
 TURN PF
 • 2360 IFJ<5ORJ=7THENC\$(U)="THE IGNORANT B
 RUTE IS SILENT.":N=U:BO\$=" [c 7]":GOTO254
 0 GH
 • 2370 IFLF<B*10RJ>11ORRND(U)<.8THEN2400 KA
 • 2380 C\$(U)=CHR\$(34)+M\$(14)+CHR\$(34):C\$(T
)="MURMURS THE "+T\$(J)+"." IJ
 • 2390 BO\$=" [PURPLE]":MC\$=" [YELLOW]":N=T:D
 L(CL+D(CD),U)=-J:GOSUB2540:RETURN DG
 • 2400 X=(RND(U)*F):C\$(U)=CHR\$(34)+"I'LL "
 +M\$(6+X)+"!"+CHR\$(34) CE
 • 2410 X=(RND(U)*F):C\$(T)=M\$(10+X)+" THE "
 +T\$(J)+"." AN
 • 2420 BO\$=" [RED]":MC\$=" [WHITE]":N=T:GOSUB
 2540:RETURN IK
 • 2430 A=.:FORFC=.TOH:EBM=FNCP(.):IFEBM<.0
 REBM>DETHEN2460 LK
 • 2440 IF(DL(EBM,.)ANDB(7))=.THEN2460 DF
 • 2450 DL(EBM,.)=DL(EBM,.)ANDG:GOSUB2510:F
 ORX=.TO2000:NEXT:GOSUB2880:A=A+U LM
 • 2460 NEXT:IFA=.THENC\$(U)="NO TRAPS AHEAD
 " :N=U:BO\$=" [GREEN]":MC\$=" [WHITE]":GOTO2
 540 BF
 • 2470 C\$(U)="YOU AVOID TRAPS.":N=U:BO\$=" [
 RED]":MC\$=" [WHITE]":GOTO2540 IJ
 • 2480 A=.:FORD=UTOF:ONDGOSUB2630,2650,267
 0,2690:IFNTHEA=A+U:GOSUB2740 LC
 • 2490 NEXT:IFATHENGOSUB2550:RETURN BC
 • 2500 C\$(U)="YOU ARE CARRYING NOTHING.":B
 O\$=" [c 7]":MC\$=" [WHITE]":N=U:GOTO2540 LF
 • 2510 C\$(U)=M\$(36+(RND(U)*6))+":N=U:BO
 \$=" [c 3]":MC\$=" [YELLOW]":GOSUB2560:RETUR
 N CN
 • 2520 C\$(1)="YEA":C\$(2)="NAY":N=2:AA=18:G
 OSUB2570:GOSUB2790:RETURN BB
 • 2530 C\$(U)="YOU HAVE NOTHING TO "+CM\$(I
)+"!":BO\$=" [PURPLE]":MC\$=" [WHITE]":N=U KC
 • 2540 GOSUB2560:GOSUB2550:RETURN LI

• 2550 JY=PEEK(JY):J=FNJ(JY):ON-(FNJF(.))	• 2890 POKEV+34,LV(DL,):POKEV+35,LV(DL,1)
GOTO2550:WAITJOY,16,16:RETURN	:POKEV+36,LV(DL,2):Z=CZ\$(DL):RETURN
• 2560 AA=11-(N/T)	• 2900 POKE56333,127:POKE1,51:SYS901,53248
• 2570 LM=LEN(C\$(U))+F:SM=20-(LM/T):GOSUB2	,55296,61440:SYS901,53248,55296,63488
740:RETURN	LK
• 2580 N=5:FORX=UTON:C\$(X)=M\$(X):C(X)=X:NE	• 2910 POKE1,55:POKE56333,129
XT:AA=U:SM=11:LM=18:BO\$="[c 5]":MC\$="[c	• 2920 GOSUB2960:FORX=.T07:READA:POKE61440
5]"	+87*8+X,A:NEXT
• 2590 GOSUB2740:GOSUB2790:IFI=5THENX=-U:R	• 2930 POKE56578,PEEK(56578)OR3:POKE56576,
ETURN	PEEK(56576)AND252
• 2600 ONIGOSUB2630,2650,2670,2690	• 2940 POKE53272,(PEEK(53272)AND15):POKE64
• 2610 IFN=.THENC\$(U)="YOU HAVE NO "+C\$(I)	8,196:PRINTCHR\$(147):POKE648,192
+".":N=U:GOSUB2540:X=-U:RETURN	KG
• 2620 X=U:RETURN	• 2950 POKE53272,(PEEK(53272)AND240)OR12:R
• 2630 N=.:FORX=UTOK+U:IFI(X)THENN=N+U:C\$(ETURN
N)=I\$(X):C(N)=X	• 2960 READA:IFA=-1THENRETURN
• 2640 NEXT:AA=U:SM=T:LM=18:BO\$="[c 2]":MC	• 2970 FORX=.T07:READD:POKE63488+A*8+X,D:N
\$\$="[c 3]":RETURN	EXT:GOTO2960
• 2650 N=.:FORX=10T014:IFI(X)THENN=N+U:C\$(• 2980 PRINT"[CLEAR][RVSOFF] [WHITE]A H O
N)=I\$(X):C(N)=X	Y ! M A G A Z I N E [c 4]PRESENTS[6"[
• 2660 NEXT:AA=14:SM=U:LM=18:BO\$="[c 6]":M	DOWN]""]"
C\$="[GREEN]":RETURN	• 2990 PRINTTAB(7)"[BLUE]T O M B[3" "]O F[
• 2670 N=.:FORX=15T024:IFI(X)THENN=N+U:C\$(3" "]H O R R O R[8"[DOWN]""]"
N)=I\$(X):C(N)=X	• 3000 PRINTTAB(5)"[c 2][DOWN]THE ULTIMATE
• 2680 NEXT:AA=U:SM=21:LM=18:BO\$="[c 4]":M	[WHITE]3-D [c 2]ADVENTURE GAME![DOWN]"
C\$="[c 5]":RETURN	• 3010 PRINTTAB(11)"[c 5]JOYSTICK [c 2]IN
• 2690 N=.:FORX=25T030:IFI(X)THENN=N+U:C\$(PORT TWO[DOWN]"
N)=I\$(X):C(N)=X	• 3020 PRINTTAB(6)"(C)1988 [c 5]CLEVELAND
• 2700 NEXT:AA=14:SM=22:LM=17:BO\$="[YELLOW	M. BLAKEMORE[DOWN]":RETURN
]":MC\$="[PURPLE]":RETURN	PF
• 2710 N=14:FORX=UTON:C\$(X)=CM\$(X):C(X)=X:	• 3030 GOSUB3130:POKES+5,K:POKES+6,255:POK
NEXT:AA=T:SM=12:LM=16	ES+F,23:A=K:D=F:FORX=UTO30:POKES+U,A
• 2720 BO\$="[BLUE]":MC\$="[c 7]":RETURN	• 3040 POKES+G,D:D=D*1.01:A=A+U:NEXT:POKES
• 2730 SYS901,CEM*256,CEM*256+SZ,SS*B(K):S	+6,G:GOSUB3050:GOSUB350:RETURN
YS901,CC,CC+SZ,SC*B(K):RETURN	• 3050 GOSUB3130:POKES+12,F:POKES+19,F:POK
• 2740 PRINTCHR\$(19):BO\$;	ES+13,241
• 2750 FORI=UTOAA:PRINT:NEXT:PRINTTAB(SM)L	• 3060 POKES+20,241:POKES+11,17:POKES+18,1
EFT\$(MB\$,LM):FORI=UTON+T	7:GOSUB50:RETURN
• 2760 PRINTTAB(SM)"*LEFT\$(B\$,LM-T)"*":NE	• 3070 FORX=ATODSTEPJ:SYSSR,,,240,X,,,17,1
XT:PRINTTAB(SM)LEFT\$(MB\$,LM)	5:NEXT:GOSUB3050:RETURN
• 2770 PRINTCHR\$(19):MC\$"[DOWN)":FORI=UTOA	• 3080 SYSSR,,,240,34,75,17,5:GOSUB3050:RE
A:PRINT:NEXT	TURN
• 2780 FORI=UTON:PRINTTAB(SM+T);"[RVSOFF]"	• 3090 A\$="251331421502421502":FORX=UTOLEN
;C\$(I)::NEXT:RETURN	(A\$)STEPH
• 2790 JY=PEEK(JY):J=FNJ(JY):ON-(FNJF(.))	• 3100 SYSSR,,,240,VAL(MID\$(A\$,X,T)),,33,
GOTO2790:PRINTCHR\$(19)	10*VAL(MID\$(A\$,X+T,U)):NEXT
• 2800 FORI=UTOAA:PRINT:NEXT:PRINT:I=U	• 3110 GOSUB3050:RETURN
• 2810 PRINTTAB(SM+T);"[WHITE]";C\$(I)	• 3120 SYSSR,,,240,F,F,129,F:GOSUB3050:RET
• 2820 JY=PEEK(JY):J=FNJ(JY):IFFNLF(.):THE	URN
NGOSUB3080:RETURN	• 3130 POKES+24,,:FORRV=.T024:POKES+RV,,:P
• 2830 IFJ<>UANDJ<>TTHEN2820	OKES+24,G:NEXT:RETURN
• 2840 PRINT"[UP]";TAB(SM+T);MC\$;C\$(I)	• 3140 DATA32,253,174,32,138,173,32,247
• 2850 IF(J=T)ANDI<NTHENI=I+U:GOTO2810	DATA183,132,193,133,194,32,253,174
• 2860 IFJ=UANDI>TTHENPRINT"[UP][UP]";:I=I	• 3160 DATA32,138,173,32,247,183,132,195
-U:GOTO2810	• 3170 DATA133,196,32,253,174,32,138,173
• 2870 PRINT"[UP]";:GOTO2810	• 3180 DATA32,247,183,160,,177,193,145
• 2880 SYS901,SS*B(K),SS*B(K)+SZ,CEM*256:S	• 3190 DATA20,165,194,197,196,208,6,165
YS901,SC*B(K),SC*B(K)+SZ,CC:RETURN	• 3200 DATA193,197,195,240,15,230,20,208
	LF
	• 3210 DATA2,230,21,230,193,208,2,230
	ON
	• 3220 DATA194,152,240,225,96,234
	IL
	• 3230 DATA162,25,181,217,9,128,149,217,20

2,16,247,96	IN	9,10,10,10,10,11,11,11,12,13	KH
•3240 DATA32,230,2,169,15,141,24,212,32,2 41,183,142,5,212,32,241,183,142	FD	•3710 DATA 0,,5,9,11,2,5,,13,11,1,5,0	PF
•3250 DATA6,212,32,241,183,142,1,212,32,2 41,183,142,,212,32,241,183,142	OE	•3720 DATA 18,18,17,2,15,21,19,18,16,3,6, 11,18,4,5,22,8,12,7,13,14,20,18,9,23	MC
•3260 DATA4,212,32,241,183,134,2,162,10,1 60,255,136,208,253,202,208,248,198	GL	•3730 DATA "()", "()", "","", "+, "+, "+, ", "*", ". /", ". /", "- ", "- "	FL
•3270 DATA2,165,2,208,240,32,230,2,96,160 ,24,169,,153,24,212,136,208,250,96,0	OM	•3740 DATA "12", "12", "0", "0", "4687", "45", "3", "3", "<=>?", ":", "9", "9"	OE
•3280 DATA0,,,248,240,232,216,184	FK	•3750 DATA DAGGER, HAND AXE, LANCE, MORNING STAR, SCIMITAR, BROADSWORD	LK
•3290 DATA28,255,165,165,255,165,165, 255	OM	•3760 DATA WAR HAMMER, DRAGONSLAYER, EXCALI BUR, BUCKLER, LEATHER JERKIN, CHAINMAIL	DD
•3300 DATA30,31,31,31,31,31,31,31,31	FD	•3770 DATAIRON PLATE, MITHRIL PLATE, COMPAS S, SCROLL, STEEL HOOK, PINTS OF ELIXIR	AJ
•3310 DATA31,248,248,248,248,248,248, 248	OM	•3780 DATA COIL OF ROPE, BLACK CLOAK, MITHR IL RING, HOLY SYMBOL, LUMP OF COAL	MC
•3320 DATA38,,,31,15,23,27,29	EH	•3790 DATA LUMP OF IRON, ALCHEMY STONE, GEM S, JEWELS, GOLD, SILVER, RARE SPICES	JJ
•3330 DATA40,,128,192,224,240,248,252,254	CA	•3800 DATA TAKE, DROP, LEFT HAND, RIGHT HAND , ARMOR, ASCEND, DESCEND, EXAMINE, INCANT	PB
•3340 DATA41,,1,3,7,15,31,63,127	DC	•3810 DATA QUAFF, HAIL, SEARCH, INVENTORY, EX IT MENU	ON
•3350 DATA42,255,,255,255,255,255,,255	BG	•3820 DATA 15,12,11,3,14,6,10,8,9	HN
•3360 DATA43,128,64,32,16,8,4,2,1	CI	•3830 DATA WEAPON, ARMOR, SPECIFIC ITEM, TRE ASURE, EXIT MENU, KNOCK YOU SILLY	BH
•3370 DATA45,,,255,255,255,255,255	HF	•3840 DATA BASH YOUR BRAINS IN, GRIND YOU TO DOGMEAT, TEAR YOU TO RIBBONS	KC
•3380 DATA47,1,2,4,8,16,32,64,128	NE	•3850 DATA GROWLS, BELLows, BARKS, ROARS, "PA SS BY, KNIGHT ERRANT"	NM
•3390 DATA60,255,254,252,248,240,224,192, 128	BE	•3860 DATA A SPRAY OF WHITE LIGHT, A CHORU S OF ANGELIC VOICES	OK
•3400 DATA61,,,,255	CJ	•3870 DATA IT TRANSFORMS IN YOUR HAND!, A BLAST OF SPARKS..CHECK INVENTORY	AN
•3410 DATA62,255,127,63,31,15,7,3,1,-1	HA	•3880 DATA COMMON, GOOD, EXCELLENT, PRECIOUS , GLITTERING, FABULOUS, CACHE, CHEST, CRATE	KO
•3420 DATA0,60,126,126,78,78,60,..	GB	•3890 DATA NO SHAFT LEADING DOWN HERE, NO SHAFT LEADING UP HERE	JG
•3430 DATA ..,.,.,.,.,.,.,.,.,.	PA	•3900 DATA"YOU DON'T HAVE THE ", THE CATA COMBS, THE SEPULCHRE	LD
•3440 DATA .,4,1,1,1,1,1,1,,1,1,,1,1,1,1,..	ML	•3910 DATA THE BARROW, YOU'RE OUT OF HEALI NG ELIXIR, YOUR VOICE ECHOES EMPTILY	CP
•3450 DATA .,1,,1,,1,1,1,1,,1,..	PN	•3920 DATA POISON DARTS, TRIPWIRE, BEAR TRA P, SPIKED PITFALL, TRAPDOOR, SNARE NOOSE	HK
•3460 DATA .,1,,1,1,,1,1,,1,1,,1,1,1,..	KK	•3930 DATA YOU DO NOT HAVE THE ALCHEMY ST ONE!, T H O U A R T S L A I N !	HF
•3470 DATA .,1,1,1,,1,1,1,,1,,1,1,..	IG	•3940 DATATHOU HAST CONQUERED THE TOMB!	BI
•3480 DATA .,,1,,1,,1,1,1,1,1,1,1,..	KM		
•3490 DATA .,1,1,1,1,1,,1,2,,1,,1,1,..	OO		
•3500 DATA ..,.,.,.,.,.,.,.,.	DO		
•3510 DATA ..,.,.,.,.,.,.,.,.	GA		
•3520 DATA .,2,1,1,,1,1,1,1,,1,1,1,1,..	PJ		
•3530 DATA .,,1,,1,,1,1,1,1,,1,..	GB		
•3540 DATA .,1,1,1,,1,1,1,1,,1,1,1,1,..	JE		
•3550 DATA .,,1,,1,,1,1,1,1,,1,..	JF		
•3560 DATA .,1,1,1,1,1,,1,1,1,1,1,1,..	PD		
•3570 DATA .,1,,1,1,1,1,1,,1,,2,..	FJ		
•3580 DATA ..,.,.,.,.,.,.,.	KO		
•3590 DATA ..,.,.,.,.,.,.,.	JN		
•3600 DATA .,4,1,8,1,1,1,,1,,1,1,8,1,1,..	KM		
•3610 DATA .,1,,1,,1,,1,1,,8,,1,..	PL		
•3620 DATA .,1,,1,,1,1,1,,8,,1,,1,..	MO		
•3630 DATA .,8,1,1,8,1,1,,1,1,1,,1,1,1,..	DB		
•3640 DATA .,1,,1,,1,1,,1,,1,,1,..	IA		
•3650 DATA .,1,,8,1,1,1,,1,1,1,1,,4,..	AC		
•3660 DATA ..,.,.,.,.,.,.,.	NL		
•3670 DATA160,194,160,152,137,110,185,110 ,170,170,170,129,172,150,172,160	HI		
•3680 DATASTIRGES, GIANT SPIDER, CONSTRICTO R, GRAVE RAT, DROW ELF, HOBGOBLIN, FUNGUS	OP		
•3690 DATA LICH PALADIN, SPECTER, REVENANT, W YVERN, GUARDIAN NAGA, DEMON KING	IJ		
•3700 DATA 1,1,2,2,3,3,4,4,5,6,6,7,7,8,8,			

TOMB.OBJ

Starting address in hex: C800

Ending address in hex: CFFF

Flankspeed required for entry! See page 63.

C800: 08 40 00 1C E0 00 23 10 78
C808: 00 04 82 10 00 07 38 00 DD
C810: 08 C4 00 01 20 00 00 00 FD
C818: 00 00 00 01 08 00 03 9C C0
C820: 00 04 62 00 00 90 00 00 17
C828: 00 00 00 00 84 00 01 CE 7C

KH	C830: 21 02 31 73 80 48 8C 40 8D	CA00: F8 44 1E CB BB 8E 63 FF D4
PF	C838: 00 12 00 00 00 00 00 00 4A	CA08: 9F 3B FF 86 03 FF 86 03 F5
MC	C840: 00 00 00 00 00 00 00 00 40	CA10: FF 86 03 FF 86 03 FF 86 A9
C848: 00 00 00 00 00 00 00 00 48	CA18: 03 FF 86 03 FF 86 03 FF 2E	
FL	C850: 00 00 00 00 00 02 00 40 92	CA20: 86 03 FF 86 03 FF 82 03 B8
OE	C858: 25 3C A4 54 FF 2A 8D FF 6A	CA28: FF 80 03 FF 80 07 FF C9 F3
C860: B1 97 FF E1 9B FF D1 FF F8	CA30: 07 FF C0 0F FF E0 1F FF 07	
LK	C868: FF FF DB DD D3 D8 FF 93 62	CA38: F0 7D FF 78 F0 E6 1F FF 16
DD	C870: 48 C1 92 48 41 12 44 22 0F	CA40: 00 10 00 00 10 00 00 00 92 F2
AJ	C878: 22 40 00 02 20 00 04 00 01	CA48: 00 00 BA 00 00 BA 00 00 BD
MC	C880: 00 00 00 00 00 00 00 00 80	CA50: FE 00 00 92 00 00 D6 00 B8
JJ	C888: 00 00 F8 00 01 FC 00 02 81	CA58: 00 EE 00 01 EF 00 0E EE 35
PB	C890: AA 00 02 72 00 02 02 00 B3	CA60: C0 1F 7D F0 3F AB F8 3F D1
ON	C898: 01 04 00 00 88 00 00 70 96	CA68: D7 FC 7F D7 FC 7F EF FC FD
HN	C8A0: 20 00 70 40 00 70 40 00 22	CA70: F7 FF DC F3 FF 9E F3 FF CB
BH	C8A8: 70 60 00 78 30 00 3C 1C 7A	CA78: 9E E3 BB 8E E3 C7 8E 00 7F
NM	C8B0: 00 1E 0E 00 3C 3C 00 78 CD	CA80: 00 78 00 00 84 00 01 4A C8
OK	C8B8: F0 00 3F E0 00 1F C0 00 A9	CA88: 10 01 02 28 03 87 28 05 7B
AN	C8C0: 00 00 00 38 FF 00 43 FF 3C	CA90: 86 90 0E CD 90 1F 7B D0 7F
CP	C8C8: C0 37 FF E0 0F FF F0 0F B0	CA98: 3D B7 F8 3D CF E4 29 B7 59
LD	C8D0: FF F0 0F FF F0 0E FF B0 80	CAA0: 64 29 CF 2C 29 FF 38 1A A5
HK	C8D8: 0E 7F 30 1E BE B8 3E DD 48	CAA8: 01 18 03 CF 00 03 B7 00 4F
BI	C8E0: BC 7F 6B 7E FC FF 9F 78 1C	CAB0: 07 CF 00 05 7A 80 0B EF 82
OBJ	C8E8: DD 8F 78 49 07 38 7F 03 D9	CAB8: 80 0D 7B 40 0D 56 C0 DC 03
DBJ	C8F0: 18 5D 03 0C 08 1E 1E 00 B9	CAC0: 03 E7 C0 07 DB E0 07 BD F4
DBJ	C8F8: 2F 35 00 0A 55 00 14 00 D0	CAC8: E0 0F DB E0 0F E7 F0 0F 6C
DBJ	C900: 04 00 40 0C 7C 60 12 BA F9	CAD0: FF F0 0F FF F0 0F FF F0 C1
DBJ	C908: 90 11 93 10 09 FF 20 07 7D	CAD8: 0F FF F0 0F FF F0 0F FF E7
DBJ	C910: BB C0 01 C7 00 1F 7D E0 D2	CAE0: F0 0F FF F0 1F FF F8 1F 09
DBJ	C918: 3F 83 F0 F3 FF 7C A1 7A 58	CAE8: FF F8 1F 7F D8 3D EF 7C 03
DBJ	C920: 1E C0 FC 05 C3 FE 03 C7 8E	CAF0: 2F BF EC 3A FA AC 2D 95 71
DBJ	C928: CF 03 CE 03 83 CE 01 C6 E6	CAF8: F6 5F 56 AE A4 DD CA 66 08
DBJ	C930: F7 01 EE E3 87 FC D1 E6 39	CB00: 00 F8 00 01 04 00 02 02 02 02
DBJ	C938: 5C 68 67 6A 13 E0 10 04 D6	CB08: 00 02 8A 00 02 02 00 02 02 02
DBJ	C940: 34 42 0F 18 66 1F 2C 5A E9	CB10: 02 00 02 03 06 03 07 09 30
DBJ	C948: 21 06 66 01 03 5A 01 07 3C	CB18: 03 8F 09 03 DF 09 0D FE AB
DBJ	C950: BD E3 0B DB D3 15 E7 AF 59	CB20: C6 1E FD E6 3F 7B F6 7F 1B
DBJ	C958: 2E E7 77 59 7E BD 71 DB C8	CB28: B7 FF BF CF F7 DF B7 FA F9
DBJ	C960: 99 60 A5 01 71 99 81 6B F8	CB30: 9F CF F2 9F FF F2 97 FF BC
DBJ	C968: 7E C1 66 C3 61 25 81 A1 7C	CB38: D2 67 FF CC 02 00 40 E7 69
DBJ	C970: 0F 00 F1 0F 00 F1 0A 00 7C	CB40: 00 3C 00 00 7E 02 00 42 3F
DBJ	C978: 51 0E 00 71 3A 00 5C DC BC	CB48: 02 00 66 02 00 66 02 02 3D 58
DBJ	C980: 00 78 0C 70 FC 12 89 FE 0D	CB50: BD 82 67 BD C2 77 FF E2 D2
DBJ	C988: 31 C1 FF 64 63 F1 C2 32 2A	CB58: 43 DB E2 5A FF 77 7E 66 11
DBJ	C990: 64 C6 64 2A 6C CC AA 66 94	CB60: 3F 7E 5A 1E 3C FF 00 01 D3
DBJ	C998: DC 24 E3 7E 71 E3 3F FF 90	CB68: 7E 80 03 FF C0 07 81 E0 94
DBJ	C9A0: E6 3E BA FC 1C 82 7A 58 EE	CB70: 0F 00 F0 0E 00 70 0E 00 FC
DBJ	C9A8: 00 31 8C 44 79 87 45 FB EC	CB78: 70 0E 00 70 3E 00 7C 1E 40
DBJ	C9B0: CF FF FE 7F FF FE 3F FF 3D	CB80: F9 BD 8F 70 FF 06 01 FF 3F
DBJ	C9B8: FE 7F FF FF FF FF 04 3B	CB88: 80 01 FF 80 01 FF 80 03 0F
DBJ	C9C0: 00 10 00 00 54 00 00 7C A1	CB90: 7E C0 06 FF 60 0F FF F0 36
DBJ	C9C8: 00 00 54 00 00 6C 00 00 89	CB98: 1F FF F8 1F 81 F8 1F 00 69
DBJ	C9D0: 6C 00 01 7D 00 03 AB 80 EA	CBA0: F8 1E 00 78 1E 00 78 1E E4
DBJ	C9D8: 07 D7 C0 0F EF E0 0D FF 65	CBA8: 00 78 1E 00 78 1E 00 78 4E
DBJ	C9E0: 60 0C FE 30 0E D6 78 0C E5	CBB0: 1E 00 78 1E 00 78 1E 00 FB
DBJ	C9E8: 6C 10 06 D6 10 00 FE 10 61	CBB8: 78 3E 00 7C FE 00 7F FE 69
DBJ	C9F0: 00 FE 10 00 FE 10 00 FE 0E	CBC0: 00 00 00 00 00 00 00 00 C0
DBJ	C9F8: 10 01 FF 00 07 FF C0 06 D7	CBC8: 00 00 7E 00 00 FF 00 00 47

CBD0:	81 00 05 81 02 00 E7 02 BF	CDA0:	40 02 DB 40 03 BD C0 03 83
CBD8:	00 E7 02 00 E7 02 73 7E 9E	CDA8:	DB C0 02 BD 40 03 DB C0 E4
CBE0:	C2 FF 7E E2 8D 7E E2 CF C3	CDB0:	02 BD 40 02 DB 40 03 E7 B9
CBE8:	7E F2 85 FF F2 B7 BD FA 43	CDB8:	C0 03 FF C0 03 FF C0 01 02
CBF0:	B5 BD FA B7 FF FA FD FF 10	CDC0:	7F 00 00 FE 80 00 FB 40 FB
CBF8:	FA FD E7 BA FD 81 BF F8 CC	CDC8:	00 F3 20 00 E6 D0 00 FD 92
CC00:	10 B0 10 39 6E 38 38 F9 E2	CDD0:	A8 00 EB D4 00 FB EA 00 21
CC08:	38 38 F0 78 3C F8 78 36 C5	CDD8:	07 EA 00 CF EA 00 DF DA 40
CC10:	76 58 3B 38 B8 3D FF 78 C0	CDE0:	00 FF B4 00 FF 68 00 00 FD
CC18:	3D 7F B8 3D B7 18 3A CB A0	CDE8:	D0 00 FD A0 00 03 40 00 9B
CC20:	38 19 77 D8 08 8F 10 00 69	CDF0:	FC 80 00 FB 00 00 FA 00 65
CC28:	FF 00 82 BD 40 47 C3 C0 74	CDF8:	00 D4 00 00 D4 00 00 DC 7F
CC30:	4F BD C0 9B C3 C0 B3 3C 0E	CE00:	00 00 FE 00 01 7F 00 02 81
CC38:	C0 67 81 E0 0A 81 50 00 9E	CE08:	DF 00 04 CF 00 0B 67 00 2E
CC40:	77 FF F7 33 FF E6 12 FF DB	CE10:	15 BF 00 2B D7 00 57 DF 1F
CC48:	AC 01 7F 40 01 7F 40 01 77	CE18:	00 57 E0 00 57 F3 00 5B F6
CC50:	36 40 01 41 40 03 77 60 24	CE20:	FB 00 2D FF 00 16 FF 00 5F
CC58:	03 7F 60 47 36 70 2B 41 95	CE28:	0B 00 00 05 BF 00 02 C0 BA
CC60:	6C 4D 77 5E 9D 7F 7E 9D 29	CE30:	00 01 3F 00 00 DF 00 00 50
CC68:	36 5E 9D 41 5C AD 77 5C B9	CE38:	5F 00 00 2B 00 00 2B DC CA
CC70:	AD 7F 6C AD 80 DC F6 FF 0C	CE40:	1C 00 70 3E 00 F8 3F 6D B0
CC78:	90 CF 00 3C 14 80 4A 00 F3	CE48:	F8 3F C7 F8 3F FF F8 3B B4
CC80:	03 7C 00 09 E7 E0 27 FF F8	CE50:	BB B8 31 93 18 23 6D C8 FA
CC88:	C4 73 F9 4E F3 D8 1F F3 E8	CE58:	07 A9 E0 0D BA E0 0C C2 61
CC90:	DC 1F F9 ED 1F FC F7 9F 28	CE60:	60 0E 7D C0 07 FA 80 01 90
CC98:	FE 70 37 F7 78 6F FB BE D9	CE68:	BA 80 00 FD 40 00 EE 00 D0
CCA0:	DF FD FF BF F6 FF 7F EF A4	CE70:	01 C7 00 01 C3 80 00 C3 42
CCA8:	FF DF EE FB E3 EE F7 6D AB	CE78:	80 00 C3 00 03 42 C0 00 C2
CCB0:	EE 70 65 ED 86 A9 EF FC 80	CE80:	E3 FF DE E1 F5 C6 C1 FA 9E
CCB8:	6D E7 81 EF F8 3F EF F0 98	CE88:	FF BA F5 C7 7F 75 41 05 3C
CCC0:	00 FC 00 01 7A 00 03 B7 F3	CE90:	BA C0 04 BF C0 09 7F F0 0A
CCC8:	00 03 CF 00 01 FE 00 00 9B	CE98:	00 F0 F0 01 E0 70 03 C0 90
CCD0:	FC 00 00 78 00 00 78 00 BE	CEA0:	F0 03 C0 F0 03 C0 E0 01 EB
CCD8:	00 78 00 00 78 00 00 78 42	CEA8:	C1 C0 01 C3 80 01 C3 80 B5
CCE0:	00 00 78 00 00 78 40 00 12	CEB0:	01 C3 80 03 C1 C0 03 C1 40
CCE8:	78 20 00 78 20 00 FC 60 77	CEB8:	E0 07 C1 F0 1D 22 5C 00 EE
CCF0:	01 FF C0 0F 00 E0 1F FF C1	CEC0:	60 00 1C F0 00 1E F8 00 45
CCF8:	F0 18 03 F0 0F FF E0 DD C3	CEC8:	3F F8 00 3F FC C6 7F EE 72
CD00:	03 BD C0 03 DB C0 02 BD E0	CED0:	83 7F ED 83 AF ED C3 AF 56
CD08:	42 02 DB 44 03 BD C6 03 F6	CED8:	ED FF AF EF 7E EF F7 3C 09
CD10:	DB C3 03 BD C3 02 DB C7 D9	CEE0:	DF 73 99 8E 22 FF 44 0C CE
CD18:	05 E7 CF 0B FF CE 17 FF C5	CEE8:	EB 30 1F 6B 78 7F BE F8 3F
CD20:	DC 2F FF DC 5F FF DC 5F A4	CEF0:	77 DD F8 E5 E3 B8 C2 FF 84
CD28:	FF BE 7F FF 7E 7F FE FE 62	CEF8:	5C C3 18 CE E1 FF 8E 00 70
CD30:	7F FE FE 7F FE FE 3F FF 6A	CF00:	0F F0 FE 0F E0 FE 0F C0 BD
CD38:	7C 1F FF F8 07 FF F0 1C E0	CF08:	7E 0F C0 7E 1F 80 3E 1F D1
CD40:	07 E7 E0 0B 7E D0 15 3C BB	CF10:	00 3E 1F 00 7E 1F 00 FC 08
CD48:	A8 2E FF 74 5F 7E FA 5F CB	CF18:	3F 00 F8 3F 01 F8 3F 01 C9
CD50:	81 FA 5F BD FA 2F FF F4 09	CF20:	F0 1F 01 F0 1F 03 E0 0F 34
CD58:	14 FF 28 0B 00 D0 04 FF 74	CF28:	03 E0 0F 47 C0 07 87 C0 72
CD60:	20 03 81 C0 02 E7 40 03 F2	CF30:	03 87 C0 03 87 80 07 87 15
CD68:	99 C0 03 DB C0 02 BD 40 62	CF38:	C0 0A C7 60 14 8A 90 FC 57
CD70:	02 DB 40 03 BD C0 02 DB ED	CF40:	7F BF 7E FB C0 EF FB F7 9E
CD78:	40 02 BD 40 03 DB C0 00 58	CF48:	EF FB F7 EF FD FF EF F6 01
CD80:	03 FF C0 03 FF C0 03 DB E6	CF50:	0C 1F F7 FF EF F3 FC 6F C3
CD88:	C0 03 BD C0 02 DB 40 02 EA	CF58:	F0 7B AF E3 B7 E7 EF D7 BF
CD90:	BD 40 03 DB C0 03 BD C0 AF	CF60:	37 FF B5 3F FC B4 9F 79 57
CD98:	03 DB C0 03 DB C0 02 BD 97	CF68:	5A EF 31 39 E0 01 FF E0 DF

CF70: 03 FF E0 03 FF F0 03 FF 4B	CFB8: 3D 38 3F DD 10 1F EF FC 67
CF78: F8 07 E1 FC 0F E0 FE FC 43	CFC0: 00 01 E0 00 07 F0 0C 0F B5
CF80: 07 80 00 0F E0 00 1F F0 08	CFC8: F8 07 0F FC 03 9F FE 03 79
CF88: 30 3F F0 E0 7F F9 C0 FF 04	CFD0: BF FF 03 BF FF F7 BB FF 07
CF90: FD C0 FF FD C0 FF DD EF DB	CFD8: FF BB FF FF 7B FF FD 7D 8B
CF98: FF DD FF FF DE FF FF BE 14	CFE0: FF F9 BD FF F1 DD FF C3 2C
CFA0: BF FF BD 9F FF BB 8F FF 09	CFE8: DD FF FF D3 FF FF C9 FF 64
CFA8: BB C3 FF CB FF FF 93 FF 87	CFF0: FF D8 FF FF A8 7F BC 7C 2B
CFB0: FF 1B FF FE 15 FF 7C 3E 9A	CFF8: 3E BB FC 1C F7 F8 08 FC 02

SCUTTLEBUTT

Continued from page 12

plus free shipping.

P.A.V.Y. Software, 314-527-4505 (see address list, page 12).

AI TYPING TUTOR

Mavis Beacon Teaches Typing by use of artificial intelligence, checking the student's progress every step of the way and tailoring an individualized course of study. Mistakes are explained in conversational sentences, rather than by bleeps and bells. Customized practice lessons include literary quotes, riddles, and facts from the Guinness Book of World Records. Other features are a Road Racer typing game, and musical "tempo typing" with onscreen metronome. Over 20 different graphs display the student's progress. \$39.95 for the C-64; \$44.95 for the Amiga.



A practice screen from Mavis Beacon.
READER SERVICE NO. 178

The Software Toolworks, 818-907-6789 (see address list, page 12).

UNSILENCED

MicroProse's *Silent Service* is again on sale in West Germany after a government agency in Bonn rescinded a 14-month old prohibition. The WWII submarine simulation had been judged

potentially harmful to youth. But MicroProse called into question the agency's criteria for determining the product harmful, and contended that banning sales to youth effectively banned sales to adults too, since the product could under those circumstances not be advertised, or sold except in stores with adults-only entrances. The ban was lifted less than 24 hours before a scheduled hearing.

With the matter settled, there's little need for editorializing—but we applaud the West German government for overturning its earlier decision. The events of 50 years ago are understandably not a source of national pride for modern-day Germans. But there's more to be gained by studying and understanding the past than by attempting to strike it from the record.

MicroProse, 301-771-1151 (see address list, page 12).

REVIEWS

Continued from page 56

tem that would not require a customer to wait while you swapped disks and entered most information twice.

With those caveats, we'll go on to say that the documentation, though slight, is adequate, and that most people should find the system easy to use. Much of this is due to onscreen prompts and messages that will lead you through each step of the transaction, many of them highlighted by flashing graphics that are designed to recapture wandering attention spans.

System requirements for using *TISAR 128*—with no deviations tolerated—are a C-128 or C-128D, a 1571 drive, and an 80-column monitor with color preferred. All disks in the system are copyable so that you can keep originals in a safe place, and each program has a "disk-doctor" to help retrieve information lost due to accidents.

CW Data Labs, 1632 Napfle Avenue,

Philadelphia, PA 19111.—Ervin Bobo

WARP SPEED!

Cinemaware

Commodore 64/128

Cartridge; \$49.95

The Commodore 64/128 has many virtues. Processing speed is not among them. Once, a computer magazine even printed a list of things for Commodore users to do while waiting for a program to load from disk.

Several manufacturers have attempted to address this annoying shortcoming with "speed up" cartridges. *Mach-5* and *Mach-128* (Access) and *Fast Load* (Epyx) are probably the best known.

Now Cinemaware has entered the field with what may prove to be the most powerful and versatile accelerator cart on the market. Though the company earned its reputation with entertainment products like *Defender of the Crown* and *King of Chicago*, skeptics will quickly become converts once they try this amazing booster box.

Like all existing accelerator units, *Warp Speed!* plugs into the Commodore's cartridge slot. It has a mode switch to select either 64 or 128 and a recessed reset button.

Warp Speed! conveniently supports the *Fast Load* command structure, including the two-key (RUN STOP and COMMODORE) combination, which eliminates typing information to load a program. It loads, saves, and formats disks up to 10 times faster than normal. A few disks, like the Quantum-Link terminal program, won't load with *Warp Speed!*, but most do.

The copy features of this menu-driven cartridge are even more impressive. It duplicates disks and files up to 40 times faster. The user can even pick several files from the same disk and copy or scratch them in one operation.

Warp Speed! supports both double- and single-sided drives, including the 1581 and MSD units. It copies files between single- and double-sided disks and enables the 1571 to function in dou-

ble-sided mode on the C-64.

Cinemaware's cartridge is also packed with goodies for programmers and "serious" users. *Warpspeed!* boasts its own mini-assembler and built-in machine language monitor. These functions, which work in disk drive memory, include the ability to "smart move" code up and down in RAM. The cartridge allows relocated loads and saves, verifies disk files from inside the monitor, can redirect output to the printer,

loads/saves disassembles under ROMs and I/O (\$d000), and incorporates an extended DOS wedge.

The machine language monitor and mini-assembler interface with the sector editor also contained in *Warpspeed!*. It edits in hex or normal ASCII text and traces directory and file track and sector links.

That may sound like a lot of features in a small package, but these are only the high spots. *Warpspeed!* has over 30

tools for casual and advanced users. Alien Technologies, a British-based development company, has clearly tried to create the ultimate accelerator cartridge. Future products may topple the new king of the speed carts from its throne, but right now, *Warpspeed!* is an indispensable aid for every Commodore computer owner.

Cinemaware, 4165 Thousand Oaks Blvd., Westlake Village, CA 91362 (phone: 805-495-6515). —Arnie Katz

TIPS AHOY!

Continued from page 44

```
•110 POKE R,255-PEEK(R):NEXT
•120 POKE 4588,56:CHAR,0,0,"[c T][c I][c
P][c S][SS][c A][c H][c O][c Y][c EP]"
•130 POKE 2604,30:WINDOW 0,0,39,24,1
•140 FOR A=160 TO 191:X$=X$+CHR$(A):NEXT
•150 SYS DEC("CC6C"),,18,4:PRINT X$:A=179
1+RND(0)
•160 CHAR ,4,2,X$:BOX 1,30-B,30-B,289+B,9
8+B
•170 A=A+1:X=SIN(A/2)*1.9+2:Y=COS(A/[PI])
*1.9+2
•180 CIRCLE 1,91,164,X,Y,,,30:CHAR ,0,20
,"+"
•190 CHAR ,4+(AAND31),4+(7ANDA/32),""
•200 CIRCLE 0,91,164,X,Y,,,30
•210 GET A$:IF A$="" THEN 170
•220 FOR A=14592TO14599:POKEA,0:NEXT
•230 FOR A=0 TO 13:CHAR ,0,A,"[40] "]:NE
XT
•240 GRAPHIC0:LIST
```

PROGRAM PAUSER

Most of us have heard of and used program pausers. With the press of a key, the list or execution of a program is stopped in its binary tracks, until another key is pressed. *Program Pauser* takes this a step forward.

Load *Program Pauser* and change the variable PSWD\$ to a secret code. (The default is "AHOY!") Run the program. Then, when you wish to pause your 128, press CONTROL and the up arrow key. The computer will pause. To restart the computer on its merry way, press RETURN, the

secret code, and RETURN.

—Shawn K. Smith
Bronx, NY

```
•100 REM PROGRAM PAUSER -- SHAWN K. SMITH
•110 FORD=6912T06999:READY:POKE,D,Y:NEXT
•120 PSWD$="AHOY!":L=LEN(PSWD$)-1
•130 POKE6955,L:POKE6976,L:FORD=DTOD+L
•140 POKED,ASC(MID$(PSWD$,L+1-P,1))
•150 P=P+1:NEXT:END
•200 DATA 169,023,141,060,003,169,027,141
•210 DATA 061,003,096,169,173,162,198,141
•220 DATA 060,003,142,061,003,096,234,201
•230 DATA 094,240,003,076,173,198,032,011
•240 DATA 027,173,004,010,041,254,141,004
•250 DATA 010,234,160,002,132,251,032,228
•260 DATA 255,240,251,201,013,240,243,164
•270 DATA 251,153,093,027,136,016,237,160
•280 DATA 002,185,088,027,217,093,027,208
•290 DATA 225,136,016,245,173,004,010,009
•300 DATA 001,141,004,010,076,000,027,234
```

PRETZEL

Here's a quick and easy demo of the power of C-128 graphics and basic trigonometry. Try changing COLOR2 and COLOR3, increment of "P", draw coords, and trig formulae. Add a "DRAW1..." statement for a third color. Or "stack" drawings by changing "GRAPHIC3,1" to "GRAPHIC3,0" and changing other aspects after your first run. The possibilities are truly endless....

—William D. Wolfe
Pittsburgh, PA

```
10 WIDTH2:COLOR0,1:COLOR4,1:GRAPHIC3,1:D
0:P=P+.01:X=60*COS(P*3)+68:Y=60*COS(P*4)
+105:DRAW3,X+22,YTOX,Y-9:DRAW2TOX,Y:LOOP
```

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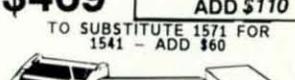
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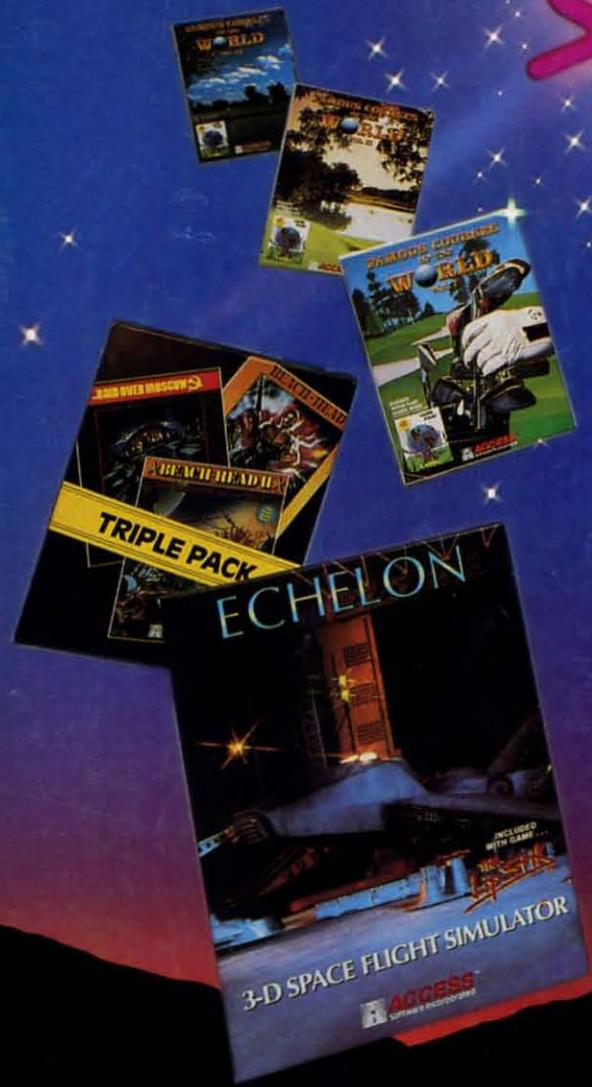
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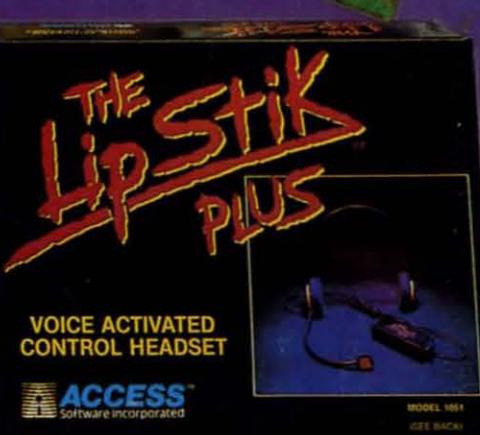
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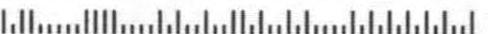
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